

Disaster Study Number 4

**Social Aspects of
Wartime Evacuation of American Cities
With Particular Emphasis on Long-Term Housing
and Reemployment**

Fred C. Iklé and Harry V. Kincaid

Committee on Disaster Studies

National Academy of Sciences—

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At present its activities are supported by a grant from the Ford Foundation, and by a special grant from the National Institute of Mental Health of the Department of Health, Education and Welfare.

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SOCIAL ASPECTS OF WARTIME EVACUATION OF AMERICAN CITIES

With Particular Emphasis on Long-Term Housing and Reemployment

by

Fred C. Iklé and Harry V. Kincaid

Bureau of Applied Social Research
Columbia University

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FOREWORD

This is the fourth in a series of disaster study reports to be published by the Committee on Disaster Studies. This series is designed to make the findings of disaster research more accessible to research workers and to agencies and officials concerned with disaster problems. It includes studies which have been completed for some time but which have not been published previously, as well as recently published studies.

The study reported here was supported by the Research and Development Division, Office of the Surgeon General, Department of the Army under Contract Number DA-49-007-MD-454 with Columbia University. The study was recommended to the Office of the Surgeon General by the Committee on Disaster Studies as part of its responsibility under Contract Number DA-49-007-MD-256 between the Department of the Army and the National Academy of Sciences-National Research Council. It is published with the permission of the Office of the Surgeon General.

There is much discussion today of "tactical dispersal" or the evacuation of urban populations from target areas upon receipt of advance warnings of enemy attack. There are other important types of evacuation, however. Dr. Iklé and Dr. Kincaid make an important contribution by outlining these different types and by focusing on problems of long-range evacuation -- such as rehousing and re-employment.

In "Social Aspects of Wartime Evacuation of American Cities" Dr. Iklé and Dr. Kincaid have made a scholarly, provocative contribution to an important field of research in which there are all too few research contributions. It is the Committee's hope that this report will provoke competent, high-level discussion of the issues involved.

The issuance of this report does not necessarily imply agreement of every member of the Committee on Disaster Studies with every statement made in the report, nor does publication imply Department of Defense indorsement of factual accuracy or opinion.

Carlyle F. Jacobsen
Chairman
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PREFACE

This research project is concerned with some of the social and economic problems associated with the wartime evacuation of American cities. Our attention is focused on problems which arise from the semi-permanent removal of large numbers of urban dwellers to safer areas (strategic evacuation) as opposed to the temporary dispersal of urban populations prior to a sudden attack (tactical evacuation).

In the literature on civil defense, evacuation has come in for its share of attention, for the subject is a timely one, and as with most timely subjects there is considerable controversy surrounding it. For example, there is by no means universal agreement that evacuation constitutes an effective civil defense measure. Some authorities have stated that mass evacuation of our cities may risk more lives than it would save and involve so many disadvantages as to be impractical. Others have asserted that evacuation is the most effective means of urban protection. Both these extreme arguments have elements of truth, but a more reasonable view doubtless lies somewhere in between.

Since 1954 great emphasis has been placed on tactical evacuation which has become the principal civil defense preparation against a surprise attack. But civil defense planning should not be limited to a surprise attack, because gradual forms of aggression may become more likely in the future, as the deterrent effect of nuclear weapons becomes increasingly stronger. Thus, in the event of serious political tension or in case of a limited war which threatens to lead to nuclear attacks against cities, strategic evacuation may some day be a desirable policy in order to strengthen our political and military posture and also to reduce the latent risk for urban populations. While it is difficult to define beforehand in which situations strategic evacuation should take place it is nonetheless necessary to examine its feasibility and limitations so as to be prepared for it. Furthermore, tactical evacuation must necessarily lead to long-term evacuation of a strategic (preventive) or remedial nature if destruction has actually occurred but there remains a threat of additional attacks, or if the devastations have been so large that most of the evacuees cannot readily return. However, both strategic and tactical evacuation are, of course, not the only means of civil defense; they have to be complemented by shelters, radiation control, stockpiling of food and medical supplies, and the like.

At this point it may be well to make explicit some of the factors that have operated in our selection of problems to be investigated in the general area of evacuation. By so doing, we may at once explain why certain problems have remained untouched by us, and where further research is needed.

Our selection of problems reflects primarily the needs of the governmental agencies concerned with the implementations of evacuation policies, most particularly the Federal Civil Defense Administration. Also important in our approach is the fact that specific civil defense plans must be framed in the light of local conditions, and must remain flexible, so that they can be applied in a variety of different situations. Therefore, our approach is necessarily general, and our selection of problems is restricted to those amenable to general treatment. We have not, for example, attempted to formulate plans for evacuation of specific cities. We feel that plans for the actual movement of large numbers of people to a given destination with given facilities is a complicated problem of logistics and therefore not the task of social science research. We are more concerned with assessing the feasibility of strategic evacuation in the first place, and with studying the social and economic problems which may arise after evacuation has been accomplished.

More specifically, our research has been guided by the following general considerations: (1) the feasibility of strategic evacuation as a civil defense measure, (2) the cost in time and resources of instituting a large-scale evacuation policy, (3) the social and economic repercussions of strategic evacuation, (4) the possible dislocations in other spheres of our national life as a result of evacuation, and (5) clarification of terminology and conceptualization of evacuation.

This project was done under Contract No. DA-49-007-MD-454 with the Medical Research and Development Division, Office of the Surgeon General, Department of the Army, upon the recommendation of the Committee on Disaster Studies of the National Academy of Sciences-National Research Council and with the cooperation of the Federal Civil Defense Administration. Mr. Harry Williams, Technical Director of the Committee on Disaster Studies gave freely of his time and of the facilities of the Committee. We are much indebted to Mr. Barent Landstreet, Tactical Evacuation Planner for the Federal Civil Defense Administration, whose assistance was invaluable.

We wish also to acknowledge the assistance of our consultants on various phases of the work. Dr. Carl Hammer of the Franklin Institute, Philadelphia, worked out the mathematical transportation model. Mr. Nathan Cherniack, Transportation Economist of the Port of New York Authority was consulted in connection with the case study of evacuation from New York City. Professor Richard Titmuss of the London School of Economics provided valuable information on the British experience in evacuation during World War II.

Dr. Stephen B. Withey, Program Director of the Survey Research Center of the University of Michigan, kindly supplied us with unpublished tabulations from a nationwide survey made by the Survey Research Center for the Federal Civil Defense Administration. His cooperation is deeply appreciated.

Mr. C. J. Lammers, of the Institute for Social Research in the Netherlands (ISONEVO) made available to us his work on the recent Dutch flood disaster. We have drawn heavily on this research in our treatment of social relations in reception communities.

Professor Kingsley Davis of the Department of Sociology, Columbia University, advised us in all phases of the research. His assistance is reflected throughout the report.

We are indebted to the staff of the project at the Bureau of Applied Social Research, without whose help the research could not have been carried out. Mr. Frank Gallo was responsible for gathering data on target cities and reception areas, and his contribution, particularly in the early phase of the project, cannot be overemphasized. Mr. Nathan Bloom worked primarily on the economic analysis of the New York Metropolitan Area. Miss Theone Michael gave valuable aid in statistical and library work. For typing and proofreading we are grateful to Mrs. Barbara Jibrin.

The responsibility of directing the research and writing the final report has been shared about equally between the authors. Dr. Ikle directed the project from its inception in July 1953 until the end of the year. At that time, Dr. Kincaid became Project Director, and he continued in that capacity until the research was completed in September 1954. While the responsibility of administration shifted, the research was a joint effort throughout.

September 1954

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CHAPTER I

INTRODUCTION

Until very recently state and local planning for civil defense in the United States has been concerned with problems likely to arise immediately before and after attacks. Thus, typical plans include pre-attack provisions for air raid warning, shelters; dispersal routes for tactical evacuation; and post-attack provisions for medical care, mass feeding, emergency housing, radiation monitoring and fire fighting. For the short run, these plans are of crucial importance for the survival of cities and their inhabitants. However, once the perspective is broadened to include long run problems, present civil defense plans appear to be inadequate.

The most glaring inadequacy has been the omission of provisions for strategic evacuating, that is the long-term evacuation of people from our large urban centers. Before proceeding to a discussion of the sociological problems of long-term evacuation, it will be well to state clearly what we mean by evacuation, for there has been considerable confusion in the past due in large part to terminological difficulties.

A. Definition and Types of Evacuation

We can distinguish three different types of population movements which come under the concept "evacuation" as a defensive or protective wartime operation. Failure to differentiate between these types leads to a confusion of goals, methods, and plans. Thus, a civil defense official may state that he is not in favor of "evacuation" -- thinking of the term in a very restricted sense -- while by another definition he is actually engaged in preparations for some other type of evacuation.

Different disasters call for divergent forms of population removal and resettlement. A certain type of evacuation appropriate in one situation may prove useless in another. For most situations a combination of evacuation types becomes necessary. Each type offers its own problems and requires a different program for implementation.

Before discussing the types of evacuation in detail, let us briefly mention industrial dispersal as opposed to evacuation, for the two terms are often confused. Evacuation is the removal of people from areas of actual or potential danger, and it is intended to last only as long as necessary. Its purpose is not a permanent relocation of people as in migration, although it might unintentionally lead to permanent changes in the population distribution. Industrial dispersal, on the other hand, attempts a permanent relocation of plants or offices outside

of large cities. Since it requires the building of new factories (or the transplanting of old ones) it cannot be done quickly except on a very small scale. To the extent that it can be realized, it is probably the most effective defense against nuclear weapons. But it would take decades to break up all industrial concentrations even if the social and economic obstacles against dispersal could be overcome -- and there is substantial evidence suggesting that they could not be overcome.¹

Returning to the typology of evacuation, Table 1 defines each type and briefly outlines the major variables involved.

Type I. Temporary Removal of Most Inhabitants²

This evacuation type, as noted in the table, has the purpose of reducing casualties in the event that there are only a few hours of advance warning. The majority of the population in a target city would be dispersed from downtown districts into suburban areas and outlying communities until the danger of attack is over. If an attack should occur, the evacuees as well as the permanent residents of outer communities, would probably have to stay in basements or other shelters for some time until the nature of the fallout threat was determined. The problems of alerting and transporting so many people within a short time are, of course, enormous.

This is the type of evacuation envisaged in most American civil defense plans and discussions of today. It has received such prominence that, until very recently, the consideration of other types has been practically excluded, probably because it seems to be the only defense in case of a sudden attack with but a few hours of advance warning. However, the problems do not end after a city's population has been moved hastily into the nearest fields, for the war is not likely to come miraculously to a close at that point. The question is what will happen to the evacuated survivors if a large part of their city has been destroyed. They cannot all crowd into the houses remaining in the city; some of them have to be dispersed by means of a more permanent

1 Cf. Project East River, "Reduction of Urban Vulnerability," Part V, Appendix B. "Minimum Density and Spacing Requirements for Metropolitan Dispersion; Forces Making for Concentration in the Cores of Metropolitan Areas" (Associated Universities, Inc.: New York, 1952); Amos H. Hawley, "Urban Dispersal and Defense," Bulletin of the Atomic Scientists (October, 1951), pp. 307-312; Fred C. Ikle, "Reconstruction and Population Density in War-Damaged Cities," Journal of the American Institute of Planners (Summer, 1950), pp. 131-139.

2 Sometimes referred to as "tactical evacuation."

TABLE I
TYPES OF EVACUATION

(1) Type	(2) Purpose	(3) Situation When Needed	(4) Alternatives If Situation In Column (3) Prevails	(5) Major Problems Involved	(6) Experience	(7) Present Planning
I. Temporary removal of most inhabitants from potential target areas upon advanced warning (leaving maintenance personnel behind); "Tactical" evacuation."	Reduce casualties	a) Sudden attack before outbreak of war b) Sudden attack after outbreak of war or when war appears imminent c) Attack after destruction has occurred in other cities	Situation a): Only alternative is shelters Situation b): Shelters or Evacuation Type II or III Situation c): Shelters or Evacuation Type II or III	1) Sufficiently advanced warning 2) Public cooperation especially under situation a) 3) Protection against Fall-out	1) "Night-time evacuation" or "Grecking" in England during World War II 2) The pre-attack evacuation movement in North Hamburg between the second and third cities 3) Communities in the U.S. threatened by a hurrican.	Planned by Federal Civil Defense; partial plans in most U.S. cities
II. Long range evacuation of non-essential personnel (primarily children and mothers) from potential or actual target areas: "Strategic evacuation (partial)"	Reduce casualties, reduce physical maintenance requirements in the target cities, and alleviate the workers' concern about the welfare of their families	a) After outbreak of war or when war appears imminent before the first attacks b) After attacks in other cities	Evacuation Type I or III	1) Separation of families 2) Billeting (crowding) and evacuee-host relationship 3) Schooling, transportation 4) Public cooperation, especially under situation a) 5) Feeding	Very extensive experience during World War II in England, further data from Germany and Japan	Detailed plans in Great Britain; but little planning in U.S.

		No planning at the present time
		To some extent the billeting of entire fam- ilies after the floods in Holland pro- vides exper- ience concern- ing housing problems
III. Long range evacuation of essential per- sonnel (workers) as well as non- essential people from actual or potential tar- get areas (leav- ing only main- tenance personnel behind)	<p>Extensive, deep shelters</p> <p>a) Tminent threat of attacks in case of prior destruction, provide hous- ing and em- ployment for the bombed- out survivors</p> <p>b) Large scale destruction and perhaps repeated attacks</p>	<ol style="list-style-type: none"> 1) Re-employment 2) Organization of the nation's economic life 3) Same as in Type II

evacuation arrangement. Furthermore, this temporary removal cannot be repeated frequently without paralyzing a city.

This temporary type of evacuation is peripheral to our project because it is primarily a transportation and communication problem. Social factors are of secondary importance except in the difficulty of motivating people to cooperate (a person is not likely to take a drastic action in order to avoid a risk which he has never experienced).

Type II. Evacuation of Nonessential Personnel

This type concerns the removal of children, mothers, and other non-essential persons from potential target cities during the time when enemy attacks are likely. The workers remain in their cities in order to keep production going.

It is certainly desirable that children and mothers are not exposed to the risk of bombing, and it is even advantageous for the economic functioning of a target city if a smaller number of inhabitants has to be supported. The reduction of maintenance requirements in this type of evacuation is particularly important after a city has been partly damaged. With fewer people to feed and house, the diminished resources of the damaged city can more easily support the working population. Furthermore, workers would no doubt feel more at ease if they knew their children were safe.

Like any evacuation strategy, this type is not free of disadvantages. First, it leads to the separation of families. The hardships of separation may cause a premature return of evacuees before bombing destruction has been experienced. Prior to the first attack it is particularly difficult to induce parents to part from their children. A further problem is to find suitable billets for children and mothers and to arrange for transportation and schooling. Experience with the problems involved in this type of evacuation in England and Germany during World War II can be utilized to draw up plans for American cities.

Type III. Evacuation of Essential and Nonessential Personnel³

A more radical dispersal of city dwellers is necessary if devastation is too great or if the attacks are too frequent to leave the working population in target cities (as would be the case in evacuation Types I and II). In this case the workers also would have to be evacuated, and they would have to be re-employed in the reception areas. Only a small core of maintenance personnel could be left in the demolished

³ Sometimes referred to as "strategic evacuation."

cities. Furthermore, this very drastic measure may be desirable to strengthen the political and military posture of the United States in case the enemy should embark upon gradual military aggression rather than risk a surprise attack.

It is this type of evacuation with which the present research is primarily concerned. It leads to a great many social problems and in many ways departs from the traditional solutions which are now under discussion on the administrative level.

Faced with the death of millions, evacuation is obviously an indispensable means of defense in spite of all its disadvantages and serious repercussions and in spite of the necessity of providing additional protection with shelters. We need not argue that it is preferable to put up with the separation of families, crowded reception areas, and any other disruptions resulting from evacuation, as against death or serious injury of millions of city dwellers. True, evacuation will displace the urban labor force and interrupt production, but it is preferable for the nation to have evacuated workers rather than dead or injured workers.

If one could choose between evacuation and continued production in target cities then all essential workers should certainly remain in the cities. This was largely the case in World War II, but given the occurrence of H-bomb explosions such a choice no longer exists. Complete emptying of all large cities, however, is not the right answer to this grave situation. A core of essential maintenance personnel must remain in the city in any event.

The three types of evacuation discussed above will be necessary in different combinations according to the warning time available, the extent of destruction, and the likelihood of repeated attacks. Type I evacuation--the hasty dispersal of the city population into the immediate surrounding area -- will be needed in case of a sudden attack with little advance warning. Type II evacuation -- the long range distribution of nonessential personnel (children, mothers, etc.) into safer communities -- will be the preferable method in case of serious political or military tension, for instance, after an ultimatum to bomb American cities, or after the outbreak of a major war and prior to bombing attacks.

This research project is focused on the third evacuation type. It is unwise to confine civil defense planning to short range evacuation, because it is adapted to only a very particular form of war, thus restricting the defense of this nation to just one of many possible forms of attack. It is particularly unrealistic to assume that the need for planning and advance preparations would end as soon as the population of our large cities had been moved into suburbs and the open country. It is doubtful whether the war would suddenly end in victory after the first attack and counterattack. More likely, future attacks

would still be possible, hence, moving back would mean seeking the death which had once been escaped. Furthermore, there may be prolonged hazards of radioactivity in many urban areas so that the return of evacuees has to be postponed.

One final argument in favor of evacuation planning is its relative inexpensiveness. There is probably no other preparation for an actual major war by which so many deaths and injuries and so much misery could be prevented at such relatively little cost. For a fraction of the cost of our military machine, it might be possible to make arrangements for saving millions of Americans from H-bomb explosions, and at the same time guaranteeing a minimum survival level for the national economy.

B. Problems of Individual Motivation and Panic

The civilian who becomes involved in evacuation or bombing destruction is suddenly faced with acute dangers and severe deprivations. He has to make momentous decisions in most unaccustomed situations and to put up with prolonged hardships the like of which he has never experienced. Unlike the soldier he is not used to following orders which imperil his life or which jeopardize his family, property, and home. In such a situation governmental orders and legislation may provide guidance, but they alone cannot motivate millions to leave their homes, to accept the trying life of long evacuation, or to brave a nuclear attack.

There has been a general awareness of the difficulty of motivating millions of civilians to act in the best interest of the nation -- as well as in their own best interest -- in a time of acute emergency. In fact, this difficulty has received so much attention that civil defense planners sometimes nearly despair of the task of obtaining coordinated action from millions of frightened city dwellers. The idea of panic has preoccupied a great many.⁴

The reports from very large disasters of the past, however, fail to show any significant mass panic among the afflicted population. Findings from Hiroshima, Nagasaki, Hamburg, and other large bombings of World War II indicate that no serious mass panic occurred

⁴ There is considerable literature on the general subject of panic. For an analysis of the literature see Enrico Quarantelli, "A Study of Panic: Its Nature, Types, and Conditions" (Unpublished Master's Thesis, Department of Sociology, University of Chicago, 1953). See also Federal Civil Defense Administration, "The Problem of Panic," Technical Bull, TB-19-2 (June, 1955).

at any time.⁵

Yet one fact is borne out by various data of past disasters: the freedom to escape from threat of death or injury has a calming effect on the population.⁶

Indeed, where panic does occur it is frequently initiated or aggravated by blocked exits. Considering this, one of the most ill-advised civil defense measures in this country was the placing of signs on outgoing highways from the large cities, indicating that these escape routes would be closed to the public in case of enemy attack. Fortunately, they will now be removed in most cities. Exactly the opposite is to be recommended, namely, well marked exit routes and instructions concerning how to leave in case of emergency.

Preventing panic, however, does not solve the problem of motivating a civilian population to follow the most rational course of action. From an analysis of World War II data and other disaster studies, two basic principles of motivation emerge: (1) the importance of the perception of the danger, or the personal experience of deprivations, and (2) the lack of alternative courses of action forcing people to pursue a course of action to which they could not be motivated otherwise.

1. The Perception of Danger and Deprivations

Statistics from World War II on successive evacuations and return movements illustrate that the population reacts primarily toward the dangers and deprivations which they have experienced or can perceive, and only secondarily toward dangers of which they hear or are warned officially, although the latter may be more important. As a result, people behave in a totally different manner before and after they have experienced bombing destruction, or before and after they have lived in

⁵ U.S. Strategic Bombing Survey (Washington: Government Printing Office, 1946-47), *passim*; John Hershey, Hiroshima (New York: Alfred A. Knopf, 1946); Takashi Nagai, We of Nagasaki (New York: Duell, Sloan and Pearce, 1951); Hamburg Police President, "(Secret) Report by the Police President of Hamburg on the Heavy Air Raids on Hamburg in July/August 1943," Translated by Great Britain, Home Office, Civil Defense Department, 1946. (Mimeographed.)

⁶ Unpublished study by the National Opinion Research Center, Disaster Research Team, University of Chicago, 1951; Darmstadt Community Survey, unpublished interviews of former evacuees, 1952. See also Lewis M. Killian, "The Significance of Multiple-Group Membership in Disaster," American Journal of Sociology, January, 1952, pp. 309-314; Irving Janis, Air War and Emotional Stress (The RAND Series; New York: McGraw-Hill, 1951).

evacuation (see Chapter III). This leads to different phases of motivation.

First, before either evacuation or bombing has been experienced, people are willing to evacuate their children on the advice and urging of the government. This statement is supported by London's evacuation of children in August 1939 prior to any significant air attacks. Between July and September 1939 about three and one-half million persons were evacuated in Great Britain.⁷

Later, people tend to move back into the cities after having experienced the deprivations of evacuation and separation of families, but before they have occasion to perceive the full danger of bombing destruction. This return movement took place in English and German cities as soon as the severity of attacks decreased or turned out to be less than expected. Abandonment of the home, the hardships of reception areas, and break-up of families will not be acceptable in the long run if the alternative is merely facing a vague risk but no actual suffering. Fear of bombing may precipitate a temporary flight from cities, but it is not a strong enough motivation to sustain a prolonged evacuation.

In a third stage -- which will be the first stage in the future in the event of a sudden, all-out bombing attack -- actual destruction in cities can be perceived instead of being a potential risk only. Particularly, the perception of dead and injured persons after a nuclear attack will prompt many to accept the deprivations of evacuation.⁸ The motivation to evacuate after having experienced a severe attack will be stronger if people are still ignorant of the hardships of evacuation, so that the counter-motivation to avoid these deprivations is still lacking. This would be the case after a sudden attack on American cities. This situation is just the opposite from the events in England, late in 1939 and early in 1940, when large bombing attacks were still unknown but the unpleasant life in evacuation was an experience strong enough to drive many back into the cities in defiance of government orders.

2. The Lack of Alternative Courses of Action

Considered outside of the proper context many aspects of evacuation doubtless seem "unacceptable" to the American public, for the

⁷ Richard M. Titmuss, Problems of Social Policy; History of the Second World War, United Kingdom Civil Series. Ed. by W.K. Hancock (London: H.M. Stationery Office, 1950), p. 102.

⁸ On the strong emotional disturbance caused by the perception of casualties see Janis, op. cit., pp. 16-17.

city dwellers as well as for the hosts in reception communities. For example, excessive encroachments upon the traditional way of life could be feared from such measures as the billeting of evacuees in private homes (the importance of this will be shown in the next chapter), the invasion of urban groups into radically different reception areas, and the movement of urban workers into smaller industrial communities.

With our discussion of these aspects we do not wish to imply that such measures would be acceptable to a free American society if the alternative were a relatively bearable life in cities. Our point is that in the event of nuclear warfare a situation will arise making all other alternatives even less acceptable to the population. A city dweller who has been bombed out and who has seen the lethal effects of nuclear weapons will be forced to find a new home, and he will generally consider billets in a private house less objectionable than camping in the open or crowding into emergency shelters. If food, housing, and employment are available in a reception area, the evacuee will soon realize that he has no better alternative than to live in his billet. Having lost his home and having perceived the danger of death in the city, he can do little else; because of shortages he can neither buy nor rent a dwelling of his own.

A paramount factor which limits alternative courses of action for a population is the daily need for food. This can actually be utilized by the government if the nation's food supply is still under its control. Through strict rationing in one place and additional provisions of food in another place, the authorities are able to provide a most effective inducement toward a desirable population distribution or evacuation policy. This method was employed effectively during World War II in Germany in order to enforce the evacuation of nonessential persons from damaged cities.⁹

It is methodologically a useful procedure to map out carefully all possible courses of action that are open to the survivors of bombing attacks, given the resources that remain after destruction. Only after thus examining the alternatives the public has left -- if any -- can one answer the question whether the public will accept a certain situation.

Our introductory remarks, primarily intended to set the stage for the body of the report, are now concluded. In the chapters to follow are given the results of our research into some of the major social and economic problems associated with evacuation, with particular attention to problems of housing, human relations in reception communities, re-employment of evacuees, and transportation.

⁹ U.S. Strategic Bombing Survey, unpublished records to European report No. 64 (Washington: Government Printing Office, 1946-47).

CHAPTER II

HOUSING

A. Billeting in Private Homes vs. Other Accommodations

During World War II the United States became familiar with the kind of housing shortage that arises even without any destruction. This shortage, considered very serious at the time, was trifling in comparison with the dearth of housing that would arise if widespread nuclear destruction were to occur. In the latter case, there would be large numbers of bombed-out and homeless city dwellers urgently in need of re-accommodation. Many of them would evacuate into safer areas instead of remaining in the target cities. Frequently, reception areas would not only have to house bombed-out people but also additional evacuees who had not yet lost their city homes (for example under pre-attack Type III evacuation).

Here we are primarily concerned with the housing problem connected with evacuation that is, with the long-range housing of evacuees in reception areas, regardless of whether their homes in the city are destroyed, damaged, or intact. Those bombed-out inhabitants who remain in their cities will have to live in slightly damaged or repaired dwellings, largely by doubling up, unless they can be accommodated in emergency shelters.

In theory, there are two principal ways to accommodate evacuees in reception areas in the long run: (1) new construction, primarily of emergency type housing, and (2) increased utilization of existing dwellings by "doubling up" and through maximum occupancy of all available vacant dwellings, hotels, dormitories, etc. Of these two methods of re-accommodation, new construction is preferable, since it avoids the many difficulties of "doubling up."

However after the outbreak of a war with nuclear attacks there will doubtless be such shortages of manpower and materials that new construction will be out of the question. All building materials and construction workers will have to be marshalled for emergency repairs and defense installations.¹ Conceivably, hutments or barracks could be

¹ It is illustrative to note the failure of the emergency building program in Hamburg after the big raids which caused destruction comparable to that from an atomic bomb. At first, much was expected from newly constructed emergency homes, and people were urged to help in the construction work on Sundays. However, five months after the raid, only

prepared in advance by pre-fabricating parts and preparing the sites. However, this would be very costly if the accommodations for a significantly large portion of the millions of homeless people were built. In the present state of civil defense preparations this expenditure could be put to far better use for more urgent preparations, such as the stockpiling of food and medical supplies and the preparation of transportation plans for quick evacuation.

Thus, it appears that evacuees will have to be housed mostly in dwellings that already exist in the reception areas. Since vacant dwellings and hotels can provide only a minute portion of the housing needed in case of large attacks, the vast majority of accommodations will have to be found in private homes.² On the basis of American housing statistics we will show below (in Section B) that the potential accommodations in private dwellings should be sufficient even if the number of evacuees is very large, provided the load can be equalized over the whole country.

Before turning to the purely statistical picture of housing, however, we must say a little more about the major advantages and disadvantages of billeting evacuees in private homes. Even the briefest consideration of the issue brings many disadvantages to mind. Richard Titmuss, who has so ably chronicled the British experience with billeting during World War II, summarizes some of its disadvantages:

...the great majority of householders who cooperated with the authorities could not help regarding the reception of evacuees as an invasion of fundamental rights, an interference with their comings and goings, a violation of the intimacies and ease of domestic life. For the authorities to impose -- and to maintain for almost five years -- a policy of billeting in private homes was a severe test of the better side of human nature. It was a formidable -- to some an intolerable -- burden for any Government to place on a section of its people. A community less self-controlled, less essentially Christian in behaviour,

1625 emergency homes had been built in Hamburg (according to the records of Hamburg's chamber of commerce), accommodating less than two per cent of the bombed-out population. Thus, more than 98 per cent of the homeless had to find accommodations in existing dwellings. In this context it must also be remembered that Hamburg's recuperation was the most remarkable of all heavily bombed cities in World War II.

2 It is clear that mass shelters like school buildings, churches, or theatres cannot house evacuees for more than a few nights without leading to the most unsanitary and unsatisfactory situations. See Titmuss, op. cit.

would not have acquiesced to the same extent and for such a long period of time as this one did.³

It is difficult to judge whether or not the American people would react similarly to billeting in private homes. The reaction would depend on the severity of the emergency situation as well as on the skill used in administering the program. One suspects that the home owners in reception areas would first respond with hospitality to the evident distress of homeless evacuees. One also suspects, that in the long run it would be as galling, if not more so, to Americans as to Britishers to be dispossessed of the privacy of their homes.

Also an important disadvantage of billeting is the fact that it requires persons of disparate social, economic, and cultural backgrounds to live in the same dwelling unit, often sharing the same kitchen and bathroom facilities. This obviously creates a situation where hostility and conflict are likely to develop.⁴

However, billeting has an advantage over mass shelters or hotels in caring for large numbers of evacuees - quite apart from the fact that enough accommodations, satisfactory for the long run, could scarcely be found without resorting to private homes.

In the case of evacuee children, the most important advantage of billeting is an atmosphere more homelike than that in an institution or hostel.

There are no doubt many more advantages and disadvantages to billeting which could be mentioned. Obviously, it is a measure of extreme complexity, involving as it does unprecedented administrative tasks, as well as hardships on the part of both host and evacuee. It should be no less obvious that such a program will be necessary in the event of all-out nuclear warfare.

B. The United States Potential for Billeting

In the last analysis, concrete plans for the rehousing of bombed

3 Ibid, p. 388.

4 To reduce tension and conflict it is desirable for evacuees to arrange their own billets, preferably with friends or relatives. This proved to be a practical procedure in the British evacuation in World War II.

These problems of social tension will be discussed in more detail below in Chapter III, including the results of a survey in the New York Metropolitan Area designed to determine the numbers of persons who would be able to arrange their own billets.

out urban dwellers will have to be made at the local community level. In order to proceed efficiently, local surveys of housing potential should be prepared so that an estimate of the community's ability to absorb evacuees can be made. Naturally, this housing potential varies widely from region to region and from community to community. It is therefore impossible for us in the present study to examine housing problems at the local community level.

In this section we have adopted a broader frame of reference by analyzing housing and population data on a national and regional level. While this type of analysis is not sufficient for local planning, it will allow us to make an estimate of the housing capacity required in the United States to absorb evacuees, and will thus provide a scale to gauge needs and capacity at the local level.

1. National Housing Potential

The United States had in 1950 almost 43 million occupied dwelling units.⁵ Of these dwellings 56 percent were located in Standard Metropolitan Areas,⁶ and about 35 percent being in relatively congested "Central Cities"⁷ of these Standard Metropolitan Areas. Thus, a large proportion of the total occupied dwelling units are either within or in close proximity to urban centers, and are therefore more or less vulnerable to attack.

The number of vacancies in the total housing supply comprises about 3 million dwelling units, or 16 percent of the total supply. However, only about 700,000 dwellings or 1.6 percent are considered available.⁸ Of the total vacancies, 414,000 are within Standard Metropolitan Areas. In the event of emergency, then, there would be only a negligible amount of available vacancies outside of congested urban areas.

The U.S. total of occupied dwelling units and population, by color, is shown in Table 2.

⁵ U.S. Bureau of the Census. U.S. Census of Housing: 1950. Vol. I. General Characteristics, Chapter 1, U.S. Summary, U.S. Government Printing Office: Washington, D.C., 1953.

⁶ For a definition of the Standard Metropolitan Area, see Ibid., p. XV.

⁷ See Ibid., p. XXVII, footnote 2, for a definition of "Central City."

⁸ According to Census definition, "An available vacant unit is a non-seasonal, not dilapidated vacant dwelling which is being offered for rent or for sale." See Ibid., p. XXVII.

TABLE 2

NUMBER OF HOUSING UNITS AND HOUSING DENSITY
BY COLOR FOR THE UNITED STATES: 1950*

	Total	White		Nonwhite	
		Number	Percent	Number	Percent
Population	150,697,361	134,942,028	89.6	15,755,333	10.4
Occupied Dwelling Units	42,826,281	39,043,595	91.2	3,782,686	8.8
Housing Density (No. of persons per dwelling unit)	-	3.3	-	3.9	-

*Sources: U.S. Bureau of the Census, U.S. Census of Population: 1950; U.S. Census of Housing: 1950.

The data in Table 2 show that the white population has a disproportionate share of the occupied dwelling units. While nonwhites comprised 10.3 percent of the total population, they occupied only 8.8 percent of the total dwelling units. In terms of persons per occupied dwelling unit, or housing density, the nonwhites live generally in more crowded conditions. For whites, the average number of persons per dwelling unit is 3.3, while for nonwhites it is 3.9. This difference complicates evacuation planning in that it will be much more difficult to find billets for nonwhites with hosts of the same race than for white evacuees. Usually less hostility develops if hosts and evacuees are matched with regard to social characteristics (see Chapter III); however, other considerations may make non-segregated billeting preferable.

Exacerbating the racial difficulty are other factors. First, there are more dilapidated nonwhite dwelling units than white.

In nonfarm housing only, the proportion of dilapidated homes among nonwhites was five times as high as among whites (27 percent as compared with 5.4 percent) and, in addition, the proportion of homes not dilapidated but lacking in one or more of piped running water, private flush toilet, private bathtub or shower was more than twice as high among nonwhites as among whites (35 percent compared with 17 percent).⁹

⁹ Housing of the Nonwhite Population: 1940 to 1950. Housing and Home Finance Agency, Washington, D. C., July 1952, p. 2.

This factor is of considerable importance in planning for evacuation, for over the long run the condition of a given dwelling unit will be a major factor in the success of a given combination of host and evacuee.

Second, the migration of nonwhites to urban centers obviously increases the potential numbers of evacuees. From 1940 to 1950, there was an increase of the nonwhite population of 46 percent in urban areas as against an increase of only 22 percent in rural nonfarm areas, while in rural areas there was a decline of 30 percent. Much of the increase is localized, moreover, in areas which were war production centers during World War II, and which are today, by and large critical target areas.¹⁰

Third, from 1940 to 1950 "the nonwhite population increased at a faster rate than the number of dwelling units it occupied."¹¹ Assuming this trend to be true from 1950 to the present, there is a constant factor adding to the already strained housing situation for nonwhites.

Summarizing, the description of housing on the national level, about 50 percent of the total occupied dwelling units are within Standard Metropolitan Areas, and of these dwellings, about 35 percent are in Central Cities, showing the high concentration of housing in vulnerable areas. In 1950 only about 1.6 percent of the total housing supply was vacant and available for occupancy, and over half of these were in vulnerable areas. Nonwhite housing would be a particularly acute problem in case of urban destruction because of the unequal density, conditions, and concentration of existing housing as between white and nonwhite.

2. Housing Potential Within Regions

We turn now to an analysis of housing and population made on the basis of regions. Since evacuees must be billeted in areas fairly close to their former homes, a regional analysis approaches in a more realistic way the potential capacity of housing to absorb evacuees.

Ideally, such an analysis would use regions homogeneous in their social and economic characteristics -- regions which might be considered as more or less self-contained systems. Actually we have used regions as defined by the Bureau of the Census, even though these are not delineated with our purpose in mind. This was done because the Census Regions are the only ones for which detailed population and housing

¹⁰ Cf. Ibid. pp. 3 ff.

¹¹ Ibid. p. 1.

data are available.¹² The regions used are listed below, along with the included states.¹³

1. New England (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut)
2. Middle Atlantic (New York, New Jersey, Pennsylvania)
3. East North Central (Ohio, Indiana, Illinois, Michigan, Wisconsin)
4. West North Central (Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas)
5. South Atlantic (Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida)
6. East South Central (Kentucky, Tennessee, Alabama, Mississippi)
7. West South Central (Arkansas, Louisiana, Oklahoma, Texas)
8. Mountain (Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada)
9. Pacific (Washington, Oregon, California)

Table 3 shows the distribution of population and housing within the regions. As might be expected, the nonwhites do not have a proportionate share of the occupied housing in any of the nine regions. This discrepancy between nonwhite population and nonwhite housing is most marked in the South Atlantic (population 24.3 percent, housing 20.9 percent) and the East South Central Regions (population 23.6 percent, housing 22.0 percent). The pattern of nonwhite housing density is fairly consistent over all the regions, with the South Atlantic and Mountain Regions having the highest densities (4.0 and 4.4 persons per occupied dwelling units respectively).

12 There is some reason to believe that the newly developed "Economic Areas" scheme would be extremely valuable for analysis of civil defense problems. Cf. Charles Lively and Cecil Gregory, "The Rural Socio-Cultural Area as a Field for Research," Rural Sociology, Vol. 19, March 1954. For a detailed discussion of the "Economic Areas" scheme, see Donald Bogue's, State Economic Areas, U.S. Government Printing Office, Washington, D.C. Unfortunately, detailed data for these Economic Areas are not readily available.

13 Strictly speaking, there are only four Census Regions, namely, (1) Northeast, (2) North Central, (3) South, and (4) West. Within each region are the "Districts" which are listed here. We have called the "Districts" regions, since "district" is an unfamiliar technical term.

TABLE 3
POPULATION, HOUSING, AND HOUSING DENSITY BY COLOR
FOR THE UNITED STATES AND REGIONS (DISTRICTS)^a: 1950

Regions	Percent of Population			Percent of Occupied Dwelling Units		Average Number of Persons per Occupied Dwelling Unit ^b		
	Total	White	Non-white	Total	White	Non-white	White	Non-white
United States	100.0	89.5	10.5	100.0	91.2	3.8	3.3	3.9
New England	100.0	98.4	1.6	100.0	98.6	1.4	3.4	3.7
Mid-Atlantic	100.0	93.6	6.4	100.0	94.4	5.4	3.4	3.6
E.N. Central	100.0	93.9	6.1	100.0	95.0	5.0	3.3	3.8
W.N. Central	100.0	96.6	3.4	100.0	96.9	3.1	3.3	3.5
South Atlantic	100.0	75.7	24.3	100.0	79.1	20.9	3.5	4.5
E.S. Central	100.0	76.4	23.6	100.0	78.0	22.0	3.7	4.0
W.S. Central	100.0	82.8	17.2	100.0	84.1	15.9	3.4	3.7
Mountain	100.0	95.5	4.5	100.0	96.6	3.4	3.3	4.4
Pacific	100.0	94.8	5.2	100.0	95.9	4.1	3.0	3.6

^aSources: U.S. Bureau of the Census, U.S. Census of Population: 1950;
U.S. Census of Housing: 1950.

^bThis figure is computed from the population actually residing in dwelling units as defined by the Census Bureau.

A sensitive indicator of the physical state of housing is the percent of dilapidated dwellings. Table 4 shows the percent of dilapidated occupied dwelling units by color of occupants. The differences in dilapidation of dwellings between regions is striking. The three Southern regions (South Atlantic, East South Central, and West South Central) have over 35 percent of the nonwhite occupied dwelling units dilapidated. These same three regions also have high proportions of dilapidated dwelling units for whites. The East South Central region is most outstanding in this respect, with about 15 percent of white, and 44 percent of nonwhite dwelling units dilapidated.

TABLE 4

DILAPIDATED OCCUPIED DWELLING UNITS BY COLOR
OF OCCUPANTS FOR REGIONS (DISTRICTS): 1950^a

	Percent Dilapidated ^b Occupied Dwelling Units	
	White ^c	Nonwhite ^c
United States	6.6	32.2
New England	4.3	25.0
Middle Atlantic	4.0	20.8
E. N. Central	5.0	22.6
W. N. Central	6.2	30.6
South Atlantic	9.3	37.1
E. S. Central	15.2	44.1
W. S. Central	12.3	38.8
Mountain	8.5	31.1
Pacific	5.0	14.2

a Sources: U.S. Bureau of the Census, U.S. Census of Housing, 1950.

b A dilapidated dwelling is defined by the Census Bureau as having one or more critical deficiencies, such as cracks, holes, etc., or of makeshift construction. For a complete definition see U.S. Bureau of the Census, U.S. Census of Housing, National Summary, pp. XVIII-XIX.

c These figures are slightly different from those noted earlier. This is due to differences in method of computation. The figures here were obtained by dividing the number of occupied dilapidated dwelling units by the total number of occupied dwelling units.

The foregoing regional description bears out in all essential respects the analysis made on the national level. Of most significance is the acute problem posed by the population distribution and housing characteristics of nonwhites. This problem will be emphasized in the following sections, which are concerned with hypothetical evacuation problems on a national, regional, and local level.

3. Housing Densities Resulting from Different Billeting Programs

In order to get some idea of the capacity of American housing for absorbing evacuees it is necessary to make assumptions concerning the number of people who will be evacuated and what constitutes a target area. Admittedly, it is difficult to make predictions in this respect, for the variables entering into the problem are many and complex. For the purpose of this analysis we have assumed two levels or degrees of evacuation and two types of reception areas. So that these assumptions will be perfectly clear, they are set down in some detail below.

In selecting reception areas we have in mind primarily evacuation of Type III (see Chapter I Section A), wherein devastation is too great, or the attacks too frequent, to leave the working population in target cities. This leads to the problem of selecting reception areas which offer employment opportunities -- particularly in essential industries -- but which at the same time are not probable targets for enemy attack.

A reasonably adequate means of gauging the suitability of a given area for re-employment purposes is given by the Bureau of the Census in their concept of "Principal Industrial Counties."¹⁴ A Principal Industrial County is defined as one having 5,000 or more manufacturing employees. Table 5 presents data not only for these counties but also for the remaining counties which contain less than 5,000 manufacturing employees.

Thus, we can now distinguish between two types of reception areas: (1) the industrial reception areas which offer employment opportunities for evacuated workers; and (2) the nonindustrial ones which are suitable only for nonessential (i.e. nonworking) evacuees.

On the assumption that only the above-mentioned Target Cities (as listed by the Federal Civil Defense Administration) shall not receive evacuees, all the remaining areas become reception areas whose capacity can be determined simply by subtraction. We computed the housing capacity separately for Industrial Reception Areas and for Total Reception Areas (industrial plus nonindustrial). Under Industrial Reception Areas were included: (a) the above-mentioned Principal Industrial Counties (excluding, of course, the Target Cities) and (b) all counties located within a Standard Metropolitan Area even if they were not classified as "Principal Industrial" (excluding again the Target City). These metropolitan fringe counties were added because a Metropolitan Area represents a more or less integrated industrial complex, so that employment opportunities can be reached from all its counties, regardless of whether more than 5,000 manufacturing employees

¹⁴ U.S. Bureau of the Census. U.S. Census of Manufactures: 1947, Vol. III, Statistics by States.

TABLE 5

CHARACTERISTICS OF TARGET COUNTIES AND INDUSTRIAL
AND NON-INDUSTRIAL RECEPTION COUNTIES: 1950^a

	Number of Counties ^b	Percentage of Total U.S. Population			Percentage of Total U.S. Manu- facturing Employees
		Total	White	Non- White	
United States	3103	100	100	100	100
Target Counties ^c	81	36	36	36	55
Non-Target Reception Counties					
a. Principal Indus- trial Counties	321	26	27	19	31
b. Non-Industrial Reception Counties	2701	38	37	45	14

a Sources: U.S. Bureau of the Census, U.S. Census of Population: 1950; U.S. Census of Manufactures: 1947.

b Target counties are those containing cities listed by FCDA as possible objects of enemy attack. Cf. Target Areas for Civil Defense Purposes, Federal Civil Defense Administration. Washington, D.C., July 1, 1953.

c These are all "Principal Industrial Counties."

are working within the county (the Census criterion of "Industrial").

Summarizing, we have the following scheme of target and reception areas:

I. Target Areas

All "Target Cities"
(as defined by F.C.D.A.)

II. Reception Areas

(1) Industrial Reception Areas
All nontarget Principal
Industrial Counties, plus
all nontarget counties of
Standard Metropolitan
Areas (regardless of

whether or not they are
"Principal Industrial").

- (2) Total Reception Areas
All counties excluding
target counties.

Finally, we made assumptions concerning levels of evacuation. In order to obtain estimates for a variety of possible situations we assumed four different evacuation levels:

Evacuation of target cities with a population of 250,000 or more

1. Sixty-five percent evacuation
2. Forty percent evacuation

Evacuation of all target cities

3. Sixty-five percent evacuation
4. Forty percent evacuation

a. Nationwide Distribution of Evacuees

Using the foregoing framework, the changes in housing density due to evacuation are analyzed first on a national scale for the purposes of a general picture of the potential of American housing to absorb evacuees. The data for this treatment appear in Table 6. The basic idea is that all evacuees could be distributed over all reception areas of the entire country. Such an ideal distribution could, of course, never be completely achieved.

For the nation as a whole, these data show that housing is probably adequate for an evacuation based on our assumptions. In only one case -- that of 65 percent evacuation of nonwhites in all target cities -- does the housing density approach a 100 percent increase.

If our assumptions as to number of evacuees make for rather an extreme case, then the housing potential seems adequate.

b. Regional Distribution of Evacuees

However, if evacuees have to be relocated within the approximate vicinity of large target cities, for reasons of food and transportation, the housing densities will undoubtedly be much higher than in the case of the nationwide distribution. Since it may not be feasible to transport evacuees over large distances, those cases have to be analyzed in which evacuees would move to reception areas only within the same region as the target cities. In other words, the load would not be equalized over the whole nation but only within a geographic region. In the

TABLE 6

CHANGES IN HOUSING DENSITY RESULTING FROM DIFFERENT LEVELS OF EVACUATION FOR THE UNITED STATES, BY COLOR OF OCCUPANT: 1950^a

Level of Evacuation		Reception Areas			
		Industrial Only		Industrial and Non-Industrial	
		White	Nonwhite	White	Nonwhite
Before Evacuation	Housing Density	3.50	4.27	3.48	4.16
40 percent Evacuation of Cities 250,000 or more	Housing Density	4.30	6.48	3.79	4.66
	Percentage Increase ^b	23	52	9	12
40 percent Evacuation of all Target Cities	Housing Density	4.46	6.72	3.85	4.71
	Percentage Increase ^b	27	57	11	13
65 percent Evacuation of Cities 250,000 or more	Housing Density	4.80	7.86	3.98	4.98
	Percentage Increase ^b	37	84	14	20
65 percent Evacuation of all Target Cities	Housing Density	5.07	8.25	4.08	5.06
	Percentage Increase ^b	45	93	17	22

a Sources: U.S. Bureau of the Census, U.S. Census of Housing: 1950; U.S. Census of Manufactures: 1947.

b Increase in housing density over density before evacuation.

regional analysis to follow, the assumptions regarding target and reception areas and levels of evacuation are the same as those used in the national analysis.

The regional increase in housing densities due to the different levels of evacuation is given in Table 7. As in the analysis on a national basis, there are marked differences between the two types of reception areas. If both industrial and nonindustrial counties ("Total

HOUSING DENSITY FOR DIFFERENT LEVELS OF EVACUATION FOR REGIONS (DISTRICTS) BY COLOR: 1950^a
 "INDUSTRIAL RECEPTION AREAS"^b

Region	Housing Density Before Evacuation	40 Percent Evacuation			65 Percent Evacuation		
		All Target Cities	Percent Change	Target Cities Over 250,000	All Cities	Percent Change	Target Cities Over 250,000
New England White	3.56	4.21	18	3.75	4.61	29	3.88
Nonwhite	4.52	9.15	102	6.42	12.04	166	7.60
Mid-Atlantic White	3.56	4.87	37	4.69	5.69	60	5.40
Nonwhite	4.63	10.46	126	10.19	14.11	205	13.67
South Atlantic White	3.59	3.98	10	3.92	4.23	18	4.12
Nonwhite	4.25	5.08	20	4.98	5.60	32	5.45
East North Central White	3.46	4.53	31	4.36	5.20	50	4.92
Nonwhite	5.14	12.52	144	11.71	17.14	233	15.81
East South Central White	3.72	4.44	19	4.29	4.89	31	4.65
Nonwhite	4.07	5.29	30	5.11	6.05	49	5.75
West North Central White	3.39	4.54	34	4.37	5.25	55	4.97
Nonwhite	3.93	9.38	139	8.62	12.78	225	11.56
West South Central White	3.50	4.31	23	4.31	4.82	38	4.82
Nonwhite	3.68	5.02	36	5.02	5.85	59	5.85
Mountain White	3.53	4.16	18	4.16	4.55	29	4.55
Nonwhite	3.98	4.97	25	4.97	5.59	40	5.59
Pacific White	3.27	4.26	30	4.18	4.88	49	4.74
Nonwhite	4.48	8.67	94	8.28	11.28	152	10.66

TABLE 7 (continued)

"TOTAL RECEPTION AREAS"^d

Region	Housing Density Before Evacuation	40 Percent Evacuation			65 Percent Evacuation			Percent Change c
		All Target Cities	Percent Change c	Target Cities Over 250,000	All Target Cities	Percent Change c	Target Cities Over 250,000	
New England	3.56 4.12	3.95 5.24	.11 27	3.67 4.58	.3 11	4.20 5.94	.18 44	3.75 4.86
	White Nonwhite							5 18
Mid-Atlantic	3.47 4.11	4.09 5.35	.18 30	4.00 5.29	.15 29	4.48 6.12	.29 49	4.34 6.03
	White Nonwhite							25 47
South Atlantic	3.92 4.43	4.08 4.69	.4 6	4.05 4.66	.3 5	4.19 4.86	.26 10	4.14 4.81
	White Nonwhite							6 9
East North Central	3.41 4.17	3.84 5.41	.13 30	3.77 5.27	.11 26	4.11 6.18	.21 48	4.00 5.96
	White Nonwhite							17 43
East South Central	3.76 4.12	3.92 4.36	.4 6	3.89 4.32	.3 5	4.02 4.51	.7 9	3.97 4.45
	White Nonwhite							6 8
West North Central	3.38 3.81	3.60 4.62	.7 21	3.56 4.51	.5 18	3.74 5.14	.11 35	3.69 4.95
	White Nonwhite							9 30
West South Central	3.49 3.84	3.66 4.08	.5 6	3.66 4.08	.5 6	3.77 4.24	.8 10	3.77 4.24
	White Nonwhite							8 10
Mountain	3.47 4.65	3.58 4.80	.3 3	3.58 4.80	.3 3	3.66 4.90	.5 5	3.66 4.90
	White Nonwhite							5 5
Pacific	3.15 4.03	3.56 5.00	.13 24	3.53 4.91	.12 22	3.82 5.60	.21 39	3.77 5.46

Footnotes to Table 7

a Sources: U. S. Bureau of the Census, U. S. Census of Population: 1950; U. S. Census of Housing: 1950; U. S. Census of Manufactures: 1947.

b "Industrial Reception Areas" are composed of all non-target Principal Industrial Counties plus all non-target counties of Standard Metropolitan Areas (excluding the "Central City"), regardless of whether or not they are "Principal Industrial."

c Percentage change using housing density before evacuation as the base.

d "Total Reception Areas" are composed of all counties excluding target counties.

Reception Areas") are utilized as reception areas, all the increases in housing densities remain below 50 percent. However, if only Industrial Reception Areas are used, certain regions appear to offer some critical problems. With respect to whites, the highest density increases occur in the Middle Atlantic, and the West North Central regions, with increases of 60 percent and 55 percent, respectively, in the case of 65 percent evacuation of all target cities.

The increases in nonwhite housing density presents problems in several regions. In three regions the increases in density are over 200 percent (Mid-Atlantic, E. N. Central, and W. N. Central), and in two others they are well over 100 percent. The highest increase, 233 percent, occurs in the East North Central Region in the case of 65 percent evacuation of all target cities.

4. Billeting of Nonessential Persons from New York in the Surrounding Area

Pre-attack evacuation of non-essential people from a target city (Type II Evacuation) constitutes a very important component of an over-all evacuation program. It is desirable to billet children (or other non-essential persons) close to their homes in order to minimize transportation requirements and to make it easier for the workers remaining in the cities to visit their evacuated family members. However, billeting in the vicinity of target cities is limited by the available housing. If the degree of crowding becomes too high, evacuees will have to be moved to more distant reception areas.

The billeting problems that arise if Type II evacuation is confined to the vicinity of a target city become clearer when a specific city is studied. For this purpose we computed how partial evacuation from New York City would affect the housing densities in the surrounding reception areas. New York City was chosen because of its great population concentration and especially because of its large number of non-whites. Moreover, the surrounding area offers a good example of moderately populated counties with an apparently good housing potential for evacuation purposes.

Our procedure was to select counties within 100 air miles of New York City as potential reception areas,¹⁵ with the housing potential of cities of 100,000 or more inhabitants excluded since these cities could be subject to attack themselves. Housing and population by color were ascertained for the reception counties and compiled on the basis of 20 mile concentric rings around the center of Manhattan. Ninety percent of New York's population under 14 years was added to the popula-

¹⁵ If over half a county's area falls within the 100 mile circle it was included as a reception county.

tion of the reception counties to determine the increase in housing density. This was also done assuming 70 percent of the people over 65 years of age were evacuated in addition to the children.

If 90 percent of New York's children were evacuated to the surrounding reception counties there would be marked differences in white and nonwhite housing available for their relocation. The following table (Table 8) indicates that if all these children were evacuated within only 20 miles or less from the city, and if evacuees were matched with respect to color, the housing densities for whites would be increased to 5.35 while the housing density for nonwhites would be increased to 12.41, thus making nonwhite housing more than twice as overcrowded.

TABLE 8

WHITE AND NONWHITE HOUSING DENSITIES FOR RECEPTION COUNTIES
BEFORE AND AFTER EVACUATION, BY DISTANCE FROM NEW YORK CITY^a

Counties by Air Distance From New York City	Number of Persons per Occupied Dwelling Units			
	Before Evacuation		After Evacuation ^b	
	White	Nonwhite	White	Nonwhite
Counties 1-20 Miles	3.47	4.85	5.35	12.41
Counties 21-40 Miles	3.56	4.80	4.67	9.34
Counties 41-60 Miles	3.58	5.42	4.45	8.72
Counties 61-80 Miles	3.56	4.46	4.26	7.69
Counties 81-100 Miles	3.57	4.43	4.11	6.95

^a Sources: U.S. Bureau of the Census, U.S. Census of Housing: 1950; U.S. Census of Population: 1950.

^b Housing densities after evacuation are computed on a cumulative basis. Thus, the housing density increase is computed for "Counties 1-20 Miles," then for "Counties 1-20" and "Counties 21-40" combined, and so on.

As more distant counties are considered as reception areas the densities, of course, decrease, but the nonwhite figure consistently remains much higher than the white. If all counties within 100 air

miles from the city are considered as reception areas for children, the density for whites would be 4.11 and the density for nonwhites would be 6.95, the latter still about 70 percent higher.

The same pattern is evident when the aged are evacuated along with the children, except that the densities become higher. If both 90 percent of the children and 70 percent of the aged are evacuated 20 miles from New York the densities would be 5.92 for whites and 13.13 for nonwhites; for all counties within 100 miles the housing density for whites and nonwhites would be 4.29 and 7.22 respectively.

These findings indicate that another solution probably will have to be sought for accommodating nonessential persons from New York, especially colored persons. The evacuees might be distributed over a wider reception area (this would complicate transportation and visiting by family members), or additional housing facilities might be used for billeting nonwhite evacuees. (The time required to transport the children out of New York City will be studied in Chapter V Section A.)

C. Increase in Housing Density

Our study of the American potential for billeting evacuees in private homes indicates how much housing density (number of persons per dwelling) will increase under different evacuation programs. Now let us discuss the feasibility and limitations of such increases in housing density. It is not our intention to attempt to set up hard and fast density limits. Indeed, such a task is probably impossible, for the limitations of increase in housing density depend on many factors which vary from one situation to another.

It is not realistic to consider housing density as a variable independent of housing supply and demand. In an emergency situation we cannot talk of "maximum housing densities" like the maximum "lawful occupancy" of theatres or restaurants established by a fire department. It is idle to say, for example, that one should not billet more than one person per room, or not more than two families per dwelling, or some such limit. One should remember that the range in housing density under ordinary peacetime conditions is very great, so that some selected communities or districts normally have average densities much larger than certain standards which might be proposed as "upper limits" for an emergency situation.¹⁶

Two principles discussed in the Introduction are important

16 In one war boom community, for example, it is reported that 53 persons slept in a six-room dwelling. See Jessie Bernard, American Community Behavior, (New York; Dryden, 1949) p. 504.

for an evaluation of housing densities, namely, the perception of danger or deprivations and the lack of alternative courses of action.

Findings from various natural disasters indicate that the gravity of the emergency as perceived by the population contributes to the willingness to accept the deprivations of billeting, both among evacuees and hosts. Below (in Section D of this Chapter) we will cite evidence from Holland's flood disaster, where a dramatic presentation of the emergency through radio and newspapers evidently helped to make billeting more acceptable. In a survey¹⁷ of several small towns in the state of Washington, householders were asked how many refugees they could take in case of emergency. The average for the four towns was 3.6 persons per household. However, from 13 to 27 percent said they would take "more if necessary," or "others in the event of a real emergency." This again illustrates that the perception of the emergency affects the hospitality of homeowners.

The lack of alternative courses of action is the real decisive influence leading to high increases in housing density. The average increase in housing density in a reception area cannot be arbitrarily limited. It is rather the ratio of the number of homeless people divided by the available accommodations. A pre-determined standard of housing density does not make sense if there are no better alternatives than to live with densities in excess of this "standard." This statement sounds perhaps like a truism, yet we expect that it may answer some objections which were provoked by our figures on billeting densities.

Let us for example, consider the following situation: A reception area is filled with evacuees whose homes are demolished, and all available accommodations have been utilized. Now, after some time it is felt that the housing densities are "unacceptable." There are, in theory, two alternatives left: either the evacuees will be forced out of their billets and left to camp in makeshift tents, huts, or shacks (we remember that the shortage of building materials rules out construction of sufficient emergency housing), or the evacuees are moved into another reception area. The first alternative seems grossly unjust to the evacuees though it may suit a few inhospitable homeowners and would probably not be tolerated by the public. The second alternative exists only if housing density is lower in other accessible reception areas. If housing density has already been approximately equalized over all reception areas, then there is no alternative left but to accept the allegedly "unacceptable" housing density.

17 "Project Revere" (Washington Public Opinion Laboratory, University of Washington).

Although the increase in housing density cannot be arbitrarily controlled, there are many ways to mitigate its undesirable consequences. An equalized distribution of evacuees among different reception areas minimizes the degree of crowding. Thus, an equal distribution within the whole nation or within regions was the underlying assumption for our statistics in Section B above. Due to transportation difficulties or a lack of employment opportunities, however, it will not be feasible to attempt a completely equal distribution among all potential reception areas in the United States. Those areas which lie closer to the target cities and which offer better employment opportunities would experience an increase in housing density above the national average (see Chapter V, Section C). Moreover, many other concessions to an equalized distribution have to be made. For example, less social tension and discomfort may result from billeting if host and evacuee are matched with regard to race and social characteristics. This may prove to be more important than a more perfect equalization of overall housing density. In some situations a compromise of the two objectives is probably the best solution. This problem will be dealt with in the next Chapter, but it is already reflected in our figures on billeting distributions by color.

In England it has also been realized that it is futile to set down definite "standards" for maximum housing densities. It is felt, according to the new plans, that the densities will have to depend on the extent of evacuation necessary.¹⁸ An equalization of evacuee distribution, however, is part of the new planning, and it was also attempted during World War II.

In the first years of the last war, some reception areas in England experienced a much larger population increase than others. From a survey of 17 counties it was estimated that the evacuees (government organized and private) accounted for an increase of 25 percent over the local population.¹⁹ Certain districts more readily accessible from London had absorbed proportionately many more evacuees than districts farther away. The government felt that there was a "degree of saturation" beyond which no more evacuees should be located in a given area. As the Ministry of Health stated:

When it is evident that the saturation point has been reached in any district, the Minister of Health,

¹⁸ Great Britain, Home Office, Civil Defense, Manual of Basic Training, Vol. I, Welfare Section. Pamphlet No. 2 (London: H.M. Stationery Office, 1951), p. 39.

¹⁹ Great Britain, Ministry of Health, Report on Conditions in Reception Areas (London: H.M. Stationery Office, 1941), p. 3.

on the advice of the Senior Regional Officer, should declare this to be a closed area. No more official parties should be sent there. Those who were homeless and others of the priority classes who could make their own arrangements for accommodation would be permitted to proceed to a closed area only on the understanding that they might be sent on elsewhere by the reception authority. They would be allowed to remain in such an area if there were adequate reasons for it. It would be inadvisable, on grounds of security, to broadcast that an area was closed. The railway companies and bus services could perhaps notify and discourage persons choosing such closed districts as their destinations. Emergency bus services to these districts should be prohibited. If, in spite of all precautions, parties of refugees arrived in a closed area, arrangements should be made in advance whereby transport was available to despatch such parties on arrival to less crowded areas.²⁰

Unfortunately, the British records contain little information as to when a "saturation point" is reached. One factor stressed was that the population increase in some districts led to a severe strain on the water supply, sanitation and sewage disposal systems.²¹

In conclusion, it will be useful to cite some examples of increased housing densities from World War II. The most detailed statistics available are for German cities; for England no exact figures can be computed because there is no housing census in Great Britain. In 14 selected German cities which had suffered little or no destruction, housing density in 1946 was higher than in 1939, the increase varying between 0.2 and 0.5 persons per room (kitchens are included in the figures for rooms.)²² These undestroyed cities served as reception areas for bombed-out evacuees who were unable to return home. German cities which did suffer destruction generally experienced a much larger increase in housing, ranging between 0.3 and 1.3 persons per room ("rooms" include kitchens). These, we must remember, are postwar figures.

20 Ibid., p. 11

21 Ibid., p. 12

22 An increase of 0.5 persons per "room" including kitchens corresponds to an increase of about 0.7 persons per room excluding kitchens (as is the case with U.S. data).

Wartime statistics are available for the outer districts of the city of Hamburg, which served as reception areas for evacuees from the bombed-out central districts, much as suburban communities might do for central cities in the United States. Hamburg's outer districts experienced increases as high as 2.10 persons per dwelling (average: 0.87) from July to October 1943 (before and after the big raid). The absolute density (number of persons per dwelling) has been equally as striking in the districts of Hamburg proper after the big raids; the increase was generally greatest in the districts which were least crowded before destruction.

D. Organization and Administration of Billeting

The administrative and organizational problems of billeting evacuees in reception areas are very complex. The success of the entire evacuation program depends largely on the way these problems are handled. Large-scale evacuation confronts the administrator with difficulties unprecedented by his peacetime experience. Therefore, one must attempt to learn as much as possible from evacuation during World War II and from natural disasters, although these situations differ greatly from the emergency that would be caused by nuclear bombing.

The two experiences most instructive for our purposes are the evacuation of flood victims in Holland in 1953 and the wartime evacuation of children in England. In the following, we will present findings from these events in so far as they bear on the problems of billeting. A more comprehensive discussion of the British wartime evacuation and Dutch flood disaster can be found in other studies.²³

According to our typology, England primarily experienced Type II

23 For the British experience, see Titmus, op. cit.; Great Britain, Ministry of Health, Report on Conditions in Reception Areas, Prepared by the Committee under Geoffrey Shakespeare (London: H.M. Stationery Office, 1941); William Boyd, Evacuation in Scotland: A Record of Events and Experiments (Publications of the Scottish Council for Research in Education, XXII, London: 1944). For the Dutch experience, see The Netherlands Central Bureau of Statistics, "Gegevens betreffende de materiële schade, veroorzaakt door de overstromingen in Februari 1953" (Data on the material damage caused by the floods in Feb., 1953) Statistical and Econometric Studies. (Statistische en econometrische onderzoeken) Vol. VIII, No. 2, 1953. H. Fukkink, "Watersnood 1953," (Flood Disaster) Aspecten van het maatschappelijk werk in Zuid-Holland, Vol. II, No. 1, 1953. J. L. Haverda, "De Sociale Devolgen Van De Watersnood," (The Social Aspects of the Floods) Maandblad Voor de Geestelijke Volksgezondheid, Vol. VIII, No. 7/8 (July-August 1953).

evacuation during the second World War, and this type is also the principal objective of the new British plans in the event of a future war. The basic policy is the removal of nonessential people from potential target areas at the time when enemy attacks appear to be imminent. Since the new plans utilize past experiences, it is particularly instructive to study the changes in planning which were introduced since the early World War II programs.

The Dutch evacuation in the winter of 1953, on the other hand, sheds light on the problems involved in re-accommodating masses of homeless people, not only nonessential persons as in England. The floods of February 1, 1953, rendered a great many people homeless within one night. In this respect it certainly provides an analogy to wartime disasters. These homeless masses had to be transported to emergency rest centers and later accommodated in more permanent billets.

No exact figures are available concerning the maximum number of evacuated persons in Holland. The total population on January 1, 1952, of all the communities which were flooded ("directly affected by the floods" was 580,814.²⁴ But not all inhabitants of these communities were rendered homeless.

Collection Centers for the Homeless

The re-accommodation of homeless evacuees proceeds usually in two stages. First the evacuees are gathered in collection centers where they can find shelter for the first night or two. The British plan to use mainly public buildings as collection or rest centers. The homeless would not be left there longer than a day or two because, on the basis of past experience, it has been found that billeting in emergency centers should be as short as possible.

A prolonged stay in a rest centre has a very undesirable and demoralizing effect on the occupants, who are apt to settle down to a most unsatisfactory type of existence and are then difficult to move. All billetable persons should be removed from the rest centres and billeted within, at most, a few days of their arrival.²⁵

²⁴ The Netherlands Central Bureau of Statistics, Het Ranggebied Zuid West Nederland (February, 1953), p. 9; The Netherlands Central Bureau of Statistics, Statistisch Bulletin, 1953, No. 37, and press releases.

²⁵ Great Britain, Ministry of Health, "Government Evacuation Scheme. Notes for Billeting Officers and Voluntary Welfare Workers," (August, 1941), p. 17.

The local authorities in Great Britain were requested to make a survey of available housing facilities to determine how many evacuees each reception area could accept. This survey takes account of public buildings, vacant dwellings, as well as private homes which could accommodate more people. The detailed results have been kept secret in order to avoid interference by the owners of housing facilities who may oppose having their houses used for billeting evacuees.

In Holland, immediately after the flood, the refugees were brought to collection centers, primarily by buses. These collection centers were usually public buildings, such as schools, community centers, and churches. Then, from the collection centers the evacuees were rapidly allocated to private homes. Therefore, the billeting in emergency collection centers lasted only one or two nights at the most.

The floods, of course, were of great concern to the entire population. Special news bulletins were broadcast in a dramatic fashion throughout the first days. As noted above, this evidently created a general atmosphere of cooperation and helpfulness and greatly facilitated the billeting of flood victims in private homes. A great number of families volunteered to house evacuees in their homes. At many collection centers there were more offers to accommodate homeless persons than were needed. Frequently the volunteering hosts drove to the collection centers and waited with their cars to transport evacuees to their homes.

In several places, e.g., Rotterdam, the allocation of evacuees among the potential hosts was organized by the church. The churches set up their own collection centers or booths within the general collection centers and prepared lists of member families who had offered their hospitality. Through this procedure, evacuees and hosts were automatically matched with regard to religion.

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Compulsory vs. Voluntary Billeting

The postwar plans in Great Britain make provisions for compulsory billeting and special tribunals to whom the householders can appeal to change or cancel a billeting order. The World War II instructions for Billeting Officers stressed that the burden of accommodating evacuees should be distributed equally among the householders in the reception areas. Billeting Officers should not hesitate, "in the interests of fair play, to use their compulsory powers if any particular householders are standing out and refusing to accept evacuees for no good reasons."²⁶

26 Ibid., p. 5.

Compulsory powers, however, were not used very vigorously during the second World War. They are obviously of little use if children alone must be billeted, since children should not have to be left with foster parents who lack willingness and sympathy. Thus, the burden of caring for evacuated children was distributed quite unequally in some reception areas. The poor and congested parts of reception towns, according to British reports, were talked into accepting children while the better off and roomier parts were left undisturbed.²⁷ In the case of homeless adults and war workers, compulsory billeting could be more widely used since adults can be accommodated in households even though they are not willingly accepted by the hosts.

The development and revisions of British evacuation plans from the beginning of World War II up to now have led to increasingly greater support for private arrangements. Evidently, experiences from the last war have proved the great value of encouraging people to select their own billets. The history of this development is worth noting since it provides a useful lesson for our civil defense planning (see Chapter III).

At the outbreak of World War II in 1939, the British Government gave no support to persons who made their own arrangements for evacuation. Notwithstanding, about 2,000,000 persons evacuated themselves between July and September 1939 compared with 1,500,000 evacuees moved by the government.²⁸ As the war progressed, the government became increasingly aware of the need for financial support to private evacuees. After March 1940, billeting allowances for privately evacuated children were paid. At first, however, these allowances were given only to parents who were found unable to pay a minimum rate to their hosts. Eventually, this help was made available to all priority classes regardless of their means.²⁹

In Germany there were two different laws providing for billets for the homeless during the last war. One was for the immediate emergency (the "reichsleistungsgesetz") authorizing billeting officers to place the homeless directly into the dwelling of the host, who had to leave the necessary furniture in the billets. The other less stringent law gave the host some time to choose from among the homeless those he would prefer to accommodate, and left him the choice of renting or removing the furniture. After the heavy raids in Hamburg only the former legal measure proved to be sufficient.

In Holland, however, voluntary offers of hospitality were fully

27 Titmuss, op. cit., p. 375.

28 Ibid., p. 102.

29 Ibid., p. 360.

sufficient to provide accommodations for all the flood victims within the very first day. In view of the large masses of homeless people this is a most important finding. It is probable that the dramatic development of the disaster and the vivid reports which were continuously broadcast contributed to the spirit of helpfulness and hospitality. The Dutch authorities did not have to make use of their powers for compulsory billeting. It need not be emphasized that voluntary billeting leads to infinitely preferable arrangements.

Billeting Allowances and Welfare Arrangements

After the last flood disaster, regulations were passed in Holland providing for billeting allowances. They established scales which allowed one person 2.50 guilders (ca. 70 cents) a day for board and lodging. If the evacuee had to be billeted in a boarding house, the allowances were higher. Payments were usually made directly to the evacuees who in turn paid their hosts according to the above rates. The payments were somewhat higher than the billeting rates to allow for pocket money.

The British early realized the importance of adequate welfare arrangements in the reception areas to make billeting more successful. For example, clubs and centers for communal feeding offer the evacuees an opportunity to leave the home of their host temporarily. Similarly "buffer hostels" relieve the strain of sharing a home for both evacuees and hosts in case of sickness or other emergencies. Weekend hostels where visiting husbands could stay also proved useful. Special hostels for difficult children make it possible to care for evacuees who could not be accommodated in private households.

If the evacuee's home in the city is not destroyed and he wishes to keep it, the rent for it will mean an additional burden to the cost of billeting. This leads to serious difficulties if the husband is also evacuated or in military service so that the dwelling in the city remains unused. In such cases the authorities should help the evacuees to store their furniture and give up the apartment. This will in turn mitigate the housing shortage within a city.

Clubs were organized among evacuees in Holland and proved very successful. They gave the former neighbors of the flooded villages an opportunity to meet and discuss problems of common interest. The Dutch authorities employed social workers to visit the re-accommodated families and see whether any difficulties developed. In some rare instances, hosts had to be relieved of the billeted evacuees because they proved to be too difficult for accommodation in a private home. Occasionally these "problem families" could then be located in vacant apartments or hotels. Tension and friction between billeted evacuees and the homeowner lead to the general question of evacuee-host relationships in reception areas, which will be taken up in the next Chapter.

CHAPTER III

HUMAN RELATIONS IN RECEPTION COMMUNITIES

The preceding chapter dealt primarily with the physical aspects of housing for evacuees. However, once evacuees in reception communities have been housed, issues of a new order arise. If we are correct in our view that billeting in private dwellings in relatively small communities will be the primary means of re-accommodation, it is easy to see that stresses will develop in interpersonal and intergroup relations. The purpose of this chapter is to examine these stresses with a view to seeing how their social and economic costs might be minimized.

The importance of human relations is seen by looking at evacuation as a "military" operation. It is a practical measure that permits the "retreat" or urban populations from an untenable forward position to "rear areas" of relative safety. Thus viewed, the primary objective of evacuation is to preserve urban populations for their future economic function in the war effort. If evacuee populations are to fulfill efficiently their function in a new milieu it is important that human relations be maintained with a minimum of conflict.¹

It should be emphasized at the outset that the knowledge we can bring to bear on the human problems of evacuation is quite limited. In the first place, the stresses of receiving an evacuee population are in large part a function of the nature of particular reception communities. Since there is an extremely wide range of community types, we cannot deal in detail with the problems of specific communities. In the second place, there is little, if any, research directed to the specific problem with which we are concerned. Thus, we have to glean what is available from the experiences of other countries and from research findings only indirectly relevant to our purpose. These limitations obviously preclude the formulation of systematic principles of human relations in a crisis situation.

Stresses and strains in reception communities induced by an

¹ It is realized, of course, that an emergency large scale evacuation will make it necessary to forego the amenities of a more normal existence. At best, evacuation will be unpopular, and there can be little doubt that life in reception communities will be a trial to all concerned. The major goal will have to be the continued functioning of communities despite the stresses of evacuation, rather than the maintenance of the "unnecessary" amenities.

influx of evacuees will be many and complex. The increased load imposed on basic community facilities such as recreation, protection, transportation, communication, power, sanitation and health will be a serious consideration in its own right, as well as a cause of indirect stresses on orderly human relations. But we are concerned with the more direct effects on human relations due to the evacuee population itself -- its composition, its size in relation to the reception community, and the length of time it must remain evacuated.

A. Interpersonal Relations and Billeting

Even if evacuees and hosts could be perfectly matched, there would be problems of interpersonal and interfamily relations due simply to the inconvenience of the billeting situation. However, the most vulnerable target cities, and hence those supplying the majority of evacuees, characteristically contain extremely heterogeneous populations in terms of economic, social and ethnic characteristics. The descent of such a conglomerate population on reception communities to be billeted on private dwellings will almost certainly lead to interpersonal hostility and conflict.

The billeting situation is highly specific, occurring as it does only in periods of extreme emergency. It is thus difficult to generalize from the rather extensive literature on interpersonal relations under more normal conditions. For this reason, we have drawn heavily on the direct billeting experience and research of other countries. While this presents further difficulties of generalization due to national differences, it is probably the best that can be done at the present time.

British experience -- Interpersonal relations in reception communities have been studied by the British on the basis of their experiences in World War II. The consensus of opinion is that, to reduce the incidence of hostility and conflict, evacuees and host should be matched. The bulk of the British research, however, is on the common sense level, and does not provide us with a set of principles which might, with modification, guide American billeting administrators.

In general, the British assume that billeting of evacuees and hosts with markedly different patterns of behavior will tend to result in interpersonal friction. Since there is a high correlation between behavior on the one hand, and social, economic and ethnic characteristics on the other, matching with respect to the latter characteristics should tend to reduce billeting problems. However, there are two difficulties that make such a simple formula debatable. First, it is well known that differences per se do not make for interpersonal hostility -- one could cite many examples in which harmony was

promoted by diversity. Second, the correlation between behavior patterns and background characteristics is far from perfect. It is thus difficult to lay down principles which could guide the individual billeting officer in all his matching problems.² What actually happened in Great Britain was that the local billeting officer, usually working under incredibly difficult conditions, made the best possible combinations of evacuee and host in the light of local conditions. Time revealed where mistakes had been made, and shifts were made accordingly.

In Great Britain, the complexities of billeting were confounded by two major difficulties, namely, the lack of accurate community surveys for assessing available accommodations and characteristics of owners, and the problem of getting full cooperation from all strata of society in reception communities.

It is often emphasized in the British literature that frequent and accurate surveys of accommodations should be made. Such surveys make it possible for community officials to achieve a more just and harmonious distribution of evacuees than would otherwise be possible. In addition, the results of such surveys are vital to evacuation authorities at higher administrative levels, for without such data, rational decisions cannot be made concerning the equitable assignment of evacuees among the available reception areas. It is instructive for American evacuation planners that adequate surveys were seldom made in Great Britain. Many of the billeting difficulties in Great Britain can be traced to this lack.

The British experience also emphasizes the difficulty in getting cooperation from all persons in reception areas. For whatever reason, the upper and middle classes were often reluctant to share equally in the billeting program. This resulted in extremes of over-crowding in low-income housing, or in communities with a high proportion of low-income families. For example, Titmuss states,

...The production Departments complained that the Ministry of Health did not adopt a sufficiently firm attitude to those local authorities who used their billeting powers weakly and inequitably. 'With regard to the allegation that a great many houses of the middle classes and larger types are not being used for the accommodation of war-workers, I feel certain from my own experience that there is much truth in this,' wrote a senior official of the Ministry in April 1941. A lack of cooperation from

² This is not to say that selection of billets should proceed on a chance basis. The point is that it is not possible to set up general rules for all communities and all individuals.

'better-off' districts was remarked by the Ministry of Labour, and attention was drawn to the number of medical certificates which immediately followed the delivery of billeting notices.³

These difficulties, coupled with the imperfect knowledge of matching procedures, probably explain many of the billeting failures in the British evacuation program.

Dutch research -- Recently a study has been made by C. J. Lammers of the evacuation in the Dutch floods of 1953.⁴ This work is of particular interest for our purposes because the procedures used by the Dutch are much the same as those proposed for American evacuation in the event of war. The bulk of the Dutch flood victims were billeted in private dwellings on a voluntary basis, thus closely approximating the expected American situation. Since this study -- probably the most systematic research effort extant on billeting problems -- is clearly relevant to the problem at hand, it merits close attention. We will draw heavily on Lammers' work in this discussion of interpersonal relations.

The study of the Dutch evacuation (see Chapter II) as it relates to billeting tensions, was based on 880 interviews in April 1953, and on 490 mailed questionnaires in October 1953. Lammers is thus able to study the change in tensions over time as well as the factors associated with tensions at two different time periods.

Not unexpectedly, Lammers found a significant increase of inter-family tensions over time. Thus, systematic research bears out what might be gathered from a commonsense knowledge of human behavior.

3 Titmuss, op. cit., p. 392.

4 C. J. Lammers, "Survey of Evacuation Problems and Disaster Experiences," Studies in Holland Flood Disaster 1953, Volume II (Amsterdam: Institute for Social Research in the Netherlands, 1955). For a description of the flood situation, see J. Haveman, "Introduction," op. cit., Volume I, pp. 3-15. For case studies of certain aspects of the evacuation, see L. W. Nauta, et al, "Community Studies," op. cit., Volume III, especially pp. 115-151, 190-199. For a summary of findings of Volumes I, II, and III of Studies of Holland Flood Disaster 1953, see J. E. Ellemers, "General Conclusions," op. cit., Volume IV. These studies were arranged for and sponsored by the Committee on Disaster Studies, National Academy of Sciences-National Research Council which was sponsored at that time by the Medical Services of the Army, Navy, and Air Force. Professor Sj. Groenman is Director of the Institute for Social Research in the Netherlands.

People can adjust to remarkable hardships if they can see an early end to those hardships. And this initial adjustment is aided by an outburst of altruism and sympathy on the part of hosts. However, when the prospect of long-term inconveniences is perceived, and when sympathy is more or less displaced by "selfish" attitudes, tensions increase.

This finding is particularly instructive, because the Dutch evacuation never had to be viewed as even a semi-permanent affair. Return to the stricken areas was in the foreseeable future for almost all evacuees. Evacuation of American cities would be, on the other hand, very likely to last over more extended periods of time. It is therefore probable that America would experience even more drastic increases in tensions than the Dutch, due simply to the time factor.

Lammers' work also included an examination of numerous factors that seemed to be related to the presence or absence of tension. Through an elaborate statistical analysis, he found that the following were the most significant factors in the incidence of tensions at the respective time periods noted below.

I. Factors Relevant in April 1953

A. Different Sub-cultures. Indexes of sub-culture, based on religious characteristics, were found to be the single most significant factor associated with billeting tensions. An evacuee of one sub-culture billeted with a host of a different sub-culture, resulted in more tensions than in the case where evacuee and host were similar in this respect.

B. Employment. There was significantly less tension between families within a billet if the head of the evacuee family was unemployed. This seemingly anomalous finding is discussed in some detail by Lammers. One might expect that the frustration induced by unemployment would increase the probability of tension between families.

C. Previous Evacuation Experience. In billets where evacuees had had previous experience in evacuation, the tensions generated between host and evacuee were significantly less than they were in the case of "new" evacuees.⁵

⁵ Many Dutchmen had experienced evacuation during World War II. Frequently flood evacuees move back in with their former wartime hosts.

D. Children. Evacuee families with children experienced significantly more tensions than those without children.

II. Factors Relevant in October 1953

A. Social Status. Social status, as measured by income level, was significantly associated with tensions in October, but not in April. That is, host and evacuee families with different income levels experienced more tensions than families with similar income levels.

B. "Urbanity." Urbanity of the reception community, as measured by size of population, was associated with interfamily tensions, although to a lesser degree than "social status." Evacuees, the majority of whom were rural persons, reported more tensions as the urbanity of the reception community increased.

On the basis of the foregoing analysis of the factors associated with interfamily tension, Lammers proceeds to a theoretical discussion of the "interfamily adjustment cycle" in billeting. While this is frankly labeled as speculative and heuristic by Lammers, we feel it is worthy of attention here, based as it is on empirical research.

In outline form, the cycle proceeds through the following stages:

1. Spontaneous reception (first few days)
2. Occasional frictions
3. Trial and error efforts at adjustment
4. Modus vivendi established (one to three weeks)
5. Evacuation fatigue

1. Spontaneous reception. The first few post-disaster days are marked by an immense outpouring of sympathy and altruism. This phenomenon--evidently universal in all disasters, either natural or man-made --overcomes most if not all latent tensions. This "apparent" state of integration is strong enough to overcome even very potent tension-producing situations.⁶

6 It will be recalled that we have already suggested that this initial

2. Occasional Frictions. In this stage, the return to a more normal emotional level is made. Social imperatives reassert themselves, the inroads on privacy are more fully perceived, and the evacuee family is seen more as an intruder than as a brother-in-distress. According to Lammers, this is the first critical stage in the cycle, and it is here that the first "drop-outs" occur.

3. Trial and Error. For those who survive the trials of the preceding stage, the friction serves to stimulate efforts toward adjustment. Lammers found that this stage often led to "withdrawal" arrangements, whereby the evacuee family took over a section of the dwelling as their own bailiwick, improvising cooking facilities in bathrooms, etc. This in effect made two separate sets of living quarters.⁷

However, where trial and error efforts toward adjustments were not wholly successful, the stiffening of positions frequently occurred. Lammers found that it became a point of honor with many families to "take a stand" and hold fast.

It is in this stage that the factors of "presence of children," "employment," "differences of sub-culture," and "previous experience" seem to become most effective.

4. Modus Vivendi Established. The trial and error stage results, according to Lammers, in some sort of mutual adjustment pattern. This pattern may range from sympathetic cooperation to anti-pathetic opposition, with the majority somewhere between these extremes.

5. Evacuation Fatigue. In this stage, the long term effects of the billeting situation come into play. Attitudes of conciliation turn to attitudes of toleration. Here, evidently, the factors of "income level" and "urbanity" begin to operate, making for more strain on whatever pattern of adjustment has been hammered out.

This stage, which usually occurred after one to three months of billeting, witnesses another series of "drop-outs" and another series of adjustments.

Of course, the generalization of the foregoing results to the American scene must be cautiously approached. What is true for

period should be fully exploited for the purpose of making the best possible arrangements.

⁷ The English realized the efficacy of this measure early in World War II.

Holland is not necessarily true for America. While some of Lammers' findings may well be "universal," there is no way of being certain. Moreover, the design of Lammers' study is admittedly deficient in certain respects, and he is most cautious in his interpretation of the data even for his own country. Finally, the emergency situation in Holland differs from the situation which would confront America in wartime.

But three things emerge from the British and Dutch experience and research. First, billeting inevitably leads to problems of interpersonal relations. Second, these problems increase over time. Third, billeting of evacuees and hosts of markedly different subcultures more often than not results in tension.

B. Billeting with Friend or Relatives

Perhaps one of the most important lessons in all this for American evacuation planners is the importance of evacuees making their own arrangements for accommodation in reception areas. These arrangements, particularly with friends and relatives, are important because the probability of billeting failures is reduced thereby, if for no other reason than that social, economic and cultural differences between hosts and evacuees are minimized.⁸ Moreover, each evacuee who arranges his own movement lessens by that much the load on civil defense administrators.⁹

⁸ This is not to say that there necessarily will be less tension when friends and/or relatives are billeted together than when host and evacuee are strangers. Rather, the incidence of billeting failures is reduced. There is conflicting evidence concerning the incidence of tensions where friends or relatives are billeted together. In Germany more satisfactory evacuation experiences were reported when evacuees were billeted with friends or relatives than with strangers (see Eleanor Bernert and Fred Ikle, "Evacuation and the Cohesion of Urban Groups," American Journal of Sociology, Vol. LVIII, p. 136). However, in the recent Dutch evacuation there is some evidence that the incidence of tensions is greater among evacuees billeted with relatives than with friends or strangers (see Lammers, op. cit.). One might speculate that tensions in a billeting situation are similar regardless of whether the hosts and evacuees are friends or relatives, but that the incidence of billeting failures is much less with friends or relatives due to feelings of responsibility on the part of the host, generated by ties of kinship or friendship (see on this point, Michael Young, "The Role of the Extended Family in a Disaster," Human Relations 8: 383-391, 1954).

⁹ However, these "private" evacuees are as much a drain on housing, food, and other necessities in reception communities as "government" evacuees.

In order to get some notion of the number and characteristics of persons in target areas who can arrange their own accommodations in reception areas, we have made an exploratory survey of the New York-New Jersey area. While our study is in no way definitive, it should be useful in pointing up certain of the important problems involved.

The questions listed below were asked of approximately 1000 persons residing in the New York-New Jersey target area.¹⁰

1. Have you given any thought to what you might do if you were told that the New York-New Jersey area might be attacked with atomic or hydrogen bombs?
2. In case of the threat of such an attack, do you have somebody you could go to, or a place of your own, in the country or in a (safer) small town or suburb, where you might stay until it is safe to return?

IF YES, OR POSSIBLY:

3. Would the nearest such place be with friends, relatives, or a place of your own?
4. Where is this located?

Table 9 shows the pattern of responses to the question, "In the case of the threat of such (nuclear) attack, do you have somebody you could go to, or a place of your own in a small town or suburb, where you might stay until it is safe to return?", classified according to color and economic status of the respondents.¹¹

¹⁰ The questionnaire items were incorporated in a monthly survey conducted by Pulse Inc., of New York City. Our questions were asked at the end of an interview on radio and television program listening habits. The questions were asked of a sub-sample of the total sample interviewed by Pulse, Inc. The sample is of the modified probability type: modified in that there are no call-backs (call-backs are not feasible in a study of immediate audience behavior). Since our questions were asked only of a sub-sample, and since no call-backs were made, no claims as to the statistical representativeness can be made.

¹¹ Economic status was measured by monthly rent (or by an estimate of probable monthly rent by the interviewer in the case of home owners or no response). "High" economic status included rents of \$75. per month

TABLE 9

ARRANGEMENT OF ACCOMMODATIONS BY COLOR AND ECONOMIC STATUS
OF RESPONDENTS

Color and Economic Status	Question No. 2. "In case of threat of attack.... do you have somebody you could go to...until it is safe to return?"			
	Yes	Possibly	No	Total
<u>Total Sample</u>				
Number	275	39	686	1000
Percent	27.5	3.9	68.6	100.0
<u>Color</u>				
White				
Number	26.1	35	623	919
Percent	28.4	3.8	67.8	100.0
Nonwhite				
Number	14	4	63	81
Percent	17.3	4.9	77.8	100.0
<u>Economic Status</u>				
High				
Number	65	4	148	217
Percent	30.0	1.8	68.2	100.0
Middle				
Number	159	19	392	570
Percent	27.9	3.3	68.8	100.0
Low				
Number	51	16	146	213
Percent	23.9	7.6	68.5	100.0

These data show that 27.5¹² percent of the respondents had someone (or

or over, "Middle" includes rents of \$40. through \$74., and "Low" includes rents of \$40. or less.

12 In a recent nationwide survey made by the Survey Research Center of the University of Michigan it was found that 21.0 percent of the persons in

some place) to go in the event of atomic attack on the New York-New Jersey area. Considering that the possibility of atomic attack is rather remote, it is noteworthy that over one-quarter of the sample could state that they had some place to go. It is no doubt likely that considerably more persons could arrange for their own accommodations if the hazards of atomic war were realistically demonstrated by heightened international tension, or by actual attack in some part of the world.¹³

When the sample was grouped according to color and to economic status, it was found that persons classified as white and of "high" economic status were more likely to say they could arrange their own accommodations in reception areas. Thus, 28.4 percent of white persons as compared with 17.3 percent of nonwhite indicated they have some place to go in case of attack. In terms of economic status, there was a slight but consistent increase in number of persons saying they could arrange their own accommodations as economic status increases ("high", 30.0 percent; "middle", 27.9 percent; "low", 23.9 percent). However, when the "Yes" category is grouped with the "Possibly" category, the differences all but vanish ("high", 31.8 percent; "middle", 31.2 percent; "low", 31.4 percent).

The type of accommodations arranged for in reception areas by persons of different color and economic status is given in Table 10. Here it is shown that about 75.0 percent of those persons who have some place to go planned to stay with relatives. Only 7.6 percent planned to go to their own place, and 14.3 percent planned to stay with friends. There was a tendency for nonwhites to rely more heavily on relatives than whites, but the number of nonwhites who reported having some place to go was so small that little reliance can be placed on such a comparison. As might be expected, more persons of high economic status planned to stay in their own place than was the

Standard Metropolitan Areas had some place in mind to head for if evacuation became necessary ("Do you have any place in mind you'd head for where you could stay if you were evacuated out of town?").

13 Analysis of Question Number 1 ("Have you given any thought to what you might do if you were told that the New York-New Jersey area might be attacked with atomic or hydrogen bombs?") sheds some light on this issue. Of the 455 respondents who had not given any thought to what they might do in case of attack, only 17.4 percent said they had "some place to go." However, of the 390 respondents who had given thought to the matter, 40.3 percent had "some place to go." It appears that the number of persons having "some place to go" is under-estimated by virtue of the saliency of the problem to portions of the sample.

TABLE 10

TYPE OF ACCOMMODATIONS ARRANGED FOR IN RECEPTION AREAS BY COLOR AND ECONOMIC STATUS OF RESPONDENTS

Color and Economic Status	Type of Accommodation				
	Friends	Relatives	Own Place	Other	Totals
<u>Total Sample</u>					
Number	45	238	24	7	314
Percent	14.3	75.8	7.6	2.3	100.0
<u>Color</u>					
White					
Number	43	222	24	7	296
Percent	14.5	75.0	8.1	2.4	100.0
Nonwhite					
Number	2	16	--	--	18
Percent	11.1	88.9			100.0
<u>Economic Status</u>					
High					
Number	16	40	11	2	69.
Percent	23.2	58.0	15.9	2.9	100.0
Middle					
Number	21	145	10	2	178
Percent	11.8	81.5	5.6	1.1	100.0
Low					
Number	8	53	3	3	67
Percent	11.9	79.1	4.5	4.5	100.0

case among those in the lower economic brackets, ("high", 15.9 percent; "middle", 5.6 percent; "low", 4.5 percent). In addition, respondents of "high" economic status relied much less on relatives than did the respondents of "middle" and "low" status ("high", 58.0 percent; "middle", 81.5 percent; "low", 79.1 percent).

It is interesting to classify those respondents having some place to go in the event of attack according to destination. Table 11 shows the intended destination grouped by states, with Group Number 1 representing the area adjacent to the New York-New Jersey target area, Group Number 2 representing the "Middle Atlantic" region, and Group Number 3 consisting of all other states. Almost 20 percent of the total sample

TABLE 11

LOCATION OF ACCOMMODATIONS IN RECEPTION AREAS BY COLOR
AND ECONOMIC STATUS OF RESPONDENTS

Color and Economic Status	Group No. 1 New York, New Jersey, Conn.	Group No. 2 Maine, Vermont, New Hamp., Mass., Rhode Island, Pennsylvania	Group No. 3 All Other States	Totals
<u>Total Sample</u>				
Number	213	42	59	314
Percent	67.8	13.4	18.8	100.0
<u>Color</u>				
White				
Number	209	41	46	296
Percent	70.6	13.9	15.5	100.0
Nonwhite				
Number	4	1	13	18
Percent	22.2	5.6	72.2	100.0
<u>Economic Status</u>				
High				
Number	50	6	13	69
Percent	72.5	8.7	18.8	100.0
Middle				
Number	113	29	36	178
Percent	63.5	16.3	20.2	100.0
Low				
Number	50	7	10	67
Percent	74.6	10.5	14.9	100.0

gave intended destinations in states outside of the "Middle Atlantic" region. This raises the question as to the feasibility of "private" evacuees making long journeys in a time of emergency. While it is desirable to have evacuees make their own arrangements for accommodations, the burden imposed on the transportation system by those going long distances is a factor needing close attention.

In conclusion, the survey of the New York-New Jersey area showed that one-fourth of the persons interviewed reported they could arrange for their own accommodations in reception areas, either with friends,

relatives, or in a place of their own. By far the largest number of those able to arrange their own accommodations planned to stay with relatives or friends. Over 80.0 percent of those saying they had some place to go in the event of attack, gave intended destinations in reception areas which were within a reasonable distance of New York City. However, since approximately 20 percent gave destinations that were long distances from New York, their transportation may well conflict with other essential transportation needs in wartime.

CHAPTER IV

A PRELIMINARY DISCUSSION OF THE RE-EMPLOYMENT OF EVACUEES

A. Principles of Re-employment

We have previously mentioned the situation when evacuation of workers becomes necessary (Chapter I, Section A). We called this "Type III Evacuation," involving the movement of members of the labor force as well as nonessential persons. In evacuation of this type, the workers and their families are unable to return to the endangered or devastated cities for a considerable period of time, perhaps for the duration of the war. How can the successful reintegration of evacuated workers into the labor force in reception areas be accomplished? In order to increase war production in non-target areas and to safeguard the economic survival of the nation, the manpower of evacuees must be utilized. Thus, the major question to be dealt with is how workers evacuated from large cities can be re-employed in the reception areas. Since this problem is of such complexity and magnitude, and since comprehensive treatment of it lay beyond the time and resources of our Project, we have had to confine ourselves to the basic principles and some illustrative data. It is hoped that the suggestions and framework provided here will facilitate completion of this important task in the future.

There exist three basic possibilities for re-employment:

1. Employment at new industrial or business facilities constructed after evacuation.
2. Employment at industrial and business establishments (plants, offices, shops) which were already in the reception area prior to evacuation.
3. Agricultural employment.

1. Employment at newly created facilities.--New plants in reception areas can only make a minor contribution toward the immediate employment of evacuees since construction takes considerable time. Under a situation of extreme emergency and shortages, new plant construction as well as the dispersal of old plants from target cities will be particularly difficult. By combining the new facilities with existing establishments, the industrial expansion in reception areas can probably be accomplished more quickly. Construction of new facilities is most important for defense production of top priority.

2. Employment at existing facilities.--Many of the factories, offices, and shops located in the reception areas before the outbreak of war can employ additional workers by introducing more shifts and increasing the use of manpower in other ways. There are, however, many problems involved in this type of re-employment. First, not all facilities are "flexible" in the sense that an increase in manpower with substantially the same capital equipment will lead to an increment in production. For example, factories operating on a 24 hour basis cannot introduce additional shifts. Second, an expansion in labor force frequently requires an increase in all skill levels, hence causing special managerial and engineering problems. Third, increased production necessitates an increased supply of raw materials and/or semifinished products. In many cases the source of semifinished products lies in the devastated cities and this supply will not be available. Theoretically, the amount of raw materials needed in the devastated cities will be smaller so that the increased production in reception areas can be adequately supplied. However, it will be difficult to divert these raw materials to new destinations quickly. Finally, not only the transportation of raw materials from their sources to the reception areas, but also the shipping of processed products from the reception communities to the consumers (primarily the armed forces) will entail great difficulties.

3. Employment on farms.--Food shortages and the comparative safety of rural areas may possibly encourage urban evacuees to seek agricultural employment. However, the opportunities to engage additional workers on farms are very limited. In the first place, only a small proportion of total employment is in agricultural occupations, with only 12.2 percent of the total employed persons in agriculture in 1950.¹ In the second place, the skills required in agricultural occupations are not ordinarily possessed by the urban worker. It is thus apparent that only a small number of evacuees can be re-employed on farms.

In Section C of this Chapter we shall consider the re-employment of evacuees at existing facilities in reception areas because this kind of re-employment appears to be of primary importance for war production. Employment at newly constructed facilities cannot account for more than a small fraction of all evacuated workers (in the case of Type III Evacuation), and employment at farms would serve only as a last resort in the event of a temporary collapse of the national economy.

¹ With the increasing mechanization of agriculture, the proportion of total employed persons in agriculture is decreasing. In 1940, 18.9 percent of the employed labor force was engaged in agricultural occupations.

B. A Digression on Industrial Dispersal

The fact that the United States is faced with the possibility of large-scale destruction of manpower and productive facilities has not gone unnoticed, and a considerable amount of research has already been undertaken on this problem. Project East River, for example, dealt with the subject intensively, as have other research projects.²

In general, the major conclusion to be derived from such research is that, theoretically, prewar dispersal of industrial facilities and population constitutes the best defense against atomic attack. However, industrial decentralization before an actual attack seems unlikely to occur to the extent required to reduce significantly the vulnerability of the American economy. After attack it will no doubt be too late for large-scale dispersal of factories.

The economic and social forces which influence the growth and permanence of industrial clusters cannot, apparently, be offset by a potential danger, however serious it may be. The complex interrelationships which constitute a going industrial firm are powerful forces militating against wholesale plant dispersal. The integration of the firm and its labor supply, its transportation and communication requirements, its fixed investment in plant and facilities, and its position with respect to other firms in the area, present obstacles to dispersal. Institutional rigidities which under peacetime conditions are characteristic of normal operations, serve to preserve and enlarge locations highly vulnerable to enemy attack. Only long-range plans designed to provide advantageous economic alternatives can overcome the locational advantages which currently operate in favor of industrial clusters. This is not to deny that industrial decentralization has been taking place in segments of the economy. The point is that this process has proceeded too slowly and has not afforded dispersion to the extent required for protection against modern weapons.

C. Expansion of Existing Facilities in Reception Areas (A preliminary study with illustrative data from the New York metropolitan region)

Plans are therefore urgently needed to insure full and rapid expansion of the industrial resources remaining after enemy attack and destruction in target cities. We shall now illustrate with data from the New York metropolitan region the possibilities of expanding

² Associated Universities, Inc., Project East River (New York, October, 1952); Fred H. Merrill, Community Plan for Industrial Survival (Stanford Research Institute, Stanford, California, December, 1952); U.S. Dept. of Commerce, Industrial Dispersion Guidebook for Communities (Washington U.S. Government Printing Office, no date).

undestroyed war industries and re-employing evacuees. Computations similar to those for the New York region could be carried out for the nation as a whole.

For the discussion of industrial expansion an attempt has been made to consider only those industries which would be most essential for war production. While it is difficult to determine the importance of each industry for national defense, a possible method is to consider those industries with the greatest increase in employment during the Korean war or the period from 1939 to 1945. For example, a Bureau of Labor Statistics Index of employment³ indicates that the number of workers in the steel casting industry increased 139 percent between 1939 and 1945, employment in the electrical machinery industry went up 168 percent, and that of transportation equipment increased more than ten fold. In contrast, early in 1945 employment in textile mills stood at only 93 percent of what it had been in 1939.

The criterion of past wartime increase in employment is not an infallible index of importance. For example, employment in petroleum and coal products increased only 26 percent between 1939 and 1945, yet a more vital industry could hardly be named. Therefore it was necessary to consider factors other than employment increases during wartime. We defined the following groups as "essential industries" on the basis of the increase in wartime employment and on a priori judgments (in most cases the criterion of wartime employment increase substantiates our judgments). (19)⁴ Ordnance, (24) Basic Lumber, (28) Chemicals, (29) Petroleum Refining, (30) Rubber Products, (32) Stone, Clay, Glass Products, (33) Primary Metal, (34) Fabricated Metal Products, (35) Machinery (except Electrical), (36) Electrical Goods and Machines, (37) Transportation Equipment, (38) Instruments and Clocks, and (39) Miscellaneous Manufacturing.

To estimate to what degree production in these "essential" industries could be expanded through the employment of evacuees in reception areas, two primary sources have been used: employment trends during World War II and the Korean war, and statistics on shift operations in plants.⁵

³ "Indexes of Wage-Earner Employment and of Wage-Earner Payroll in Manufacturing Industries," Monthly Labor Review, Vol. 60, No. 6 (June, 1945), pp. 1327-1330, Table 3.

⁴ The numbers refer to Standard Industrial Classification. U.S. Bureau of the Budget, U.S. Government Printing Office (November, 1945).

⁵ An analysis of employment trends for the outer counties of the New York metropolitan region -- the potential reception counties -- was not

The maximum wartime manufacturing employment in the New York metropolitan region occurred in 1943, when over 2.2 million persons were employed in the manufacturing industries covered by our data. At the start of the Korean war in 1950, total employment of the region had increased by 10 percent over the World War II maximum, but manufacturing industries alone stood at only 88 per cent of the 1943 figure, and "essential" industries at only 70 percent. The peacetime economy apparently favored a relatively greater growth of manufacturing employment. Between 1950 and 1952, however, the number of workers in "essential" industries rose by about 15 percent (to over one million) in the New York region.

In order to increase the proportion of workers in "essential" industries to the level of the peak mobilization year of 1943, the present number of such workers in the New York region would have to be increased by over 400,000 to 1,480,000, or about 14 percent more workers than the 1943 figure. Our data permit the same analysis for any county or group of counties in the New York region; but here, we are only interested in counties which are potential reception areas for the evacuated workers from New York City. Thus, in Fairfield County, Connecticut, "essential" workers comprised 66 percent of all covered employees in that area, compared with 48 percent in 1953. Accordingly, an 18 percent expansion over present levels would seem possible in the defense industries of Fairfield County, given the present industrial facilities. Similarly, Bergen County in New Jersey is currently capable of a 12 percent expansion, Essex County of 15 percent, and Hudson County of a 20 percent increase.

without difficulties. None of the State agencies ever made any retrograde adjustments of their employment data to compensate for changes in the industrial classification. The task of making different employment statistics comparable was rather laborious, but detailed time series -- once achieved -- can provide valuable information on employment flexibility. The methodology for obtaining series comparability was worked out by Mr. Maxwell Anderson of the Regional Plan Association of New York, in conjunction with the Regional Plan Association's study entitled, Employment Trends 1942-1951, in the New Jersey-New York-Connecticut Metropolitan Region, Regional Plan Bulletin Number 84.

The counties which we included in the New York region are: in New York State, New York, Bronx, Queens, Kings, Nassau, Richmond, Dutchess, Orange, Putnam, Rockland, Suffolk, and Westchester; in the state of New Jersey, Bergen, Essex, Hudson, Middlesex, Monmouth, Passaic, Somerset, and Union; and in Connecticut, Fairfield.

The estimates on employment are based on data compiled by the New York, New Jersey, and Connecticut Departments of Labor in connection with their employment security programs.

Without a detailed industry-by-industry study it is impossible to say how quickly such increases in employment could take place. If evacuees have to find employment, and if the production loss from destroyed factories has to be compensated, speed is, of course, of paramount importance.

We now turn to our second set of figures to estimate employment flexibility: the data on shift operations. We impose upon the single-shift-eight-hour day, the expansion incidental to the adoption of multiple-shift operations. Here again we project World War II experience. It is not implied, however, that the nation could not make a much greater effort than in 1943 to expand its war industries.

A wartime study by the Bureau of Labor Statistics⁶ of the distribution of workers in metal work, chemicals, ordinance, and smelting and refining showed that 72 percent were employed on the first shift, 20 percent on the second shift, and 8 percent on the third shift. In the group of plants reporting the heaviest second and third shift schedules (chemicals, explosives, brass, bronze, copper products and machine tools) shift employment was distributed on about a 5-3-2 ratio.

A subsequent Bureau of Labor Statistics study⁷ revealed that 40 percent of wage earners working in war production plants in February of 1942 were on evening and night shifts. "Generally speaking," Houghton states, "it is possible to employ at least as many workers on the evening and night shifts in combination, as on the day shift."

It is likely that the September 1953 employment figures represented, on the average, employment on a single 8-hour shift. Therefore, after a period of preparation, regional defense employment may be increased by from 28 to 50 percent, by virtue of adoption, or expansion of second and third shift operations and fuller exploitation of existing capital equipment. A 28 percent expansion in "essential" industries would serve to raise the 1953 regional total from 1.08 million workers to 1.31 million. Increasing "essential" employment by 50 percent would give the region a total of 1.62 million workers in defense industries. On the basis of a 30 percent ratio of "essential" industry workers to total covered employment -- the percentage existing in 1943 -- the potential number of such workers in the region would amount to approximately 1.50 million.

6 Morris Levine, "Shift Operations in Selected Defense Industries," Monthly Labor Review, Vol. 53, No. 2 (March, 1941), pp. 355-65.

7 Harrison F. Houghton, "Working Hours in War Production Plants, February 1942," Monthly Labor Review, Vol. 54, No. 5 (May, 1942), pp. 1061-65.

Should most of the productive facilities in New York City be destroyed by enemy attack, and most of the labor force evacuated, some 3 million workers would need re-employment. If the peripheral counties of the New York metropolitan region escaped such destruction, they alone could absorb and profitably employ most of New York City's "essential" workers by means of the above-mentioned expansions. Thus, given the region's total "essential" industry employment in September, 1953 amounting to 1,078,800, and subtracting New York City's 368,200 "essential" workers the peripheral counties remain with 710,600. If the industries in these peripheral counties could then be expanded by an estimated 37⁸ percent, they would be able to absorb from New York 263,000 "essential" evacuated workers, or roughly two-thirds of the city's "essential" workers.

Now it might be argued that the peripheral counties could also lose part of their productive facilities through destruction, in which case the re-employment of evacuees, and their effective reintegration into the defense effort would be made more difficult. However, there are many other industrial communities farther away which could still serve as reception areas. (In Chapter II, Section B, we gave some over-all statistical information on industrial counties outside of large target cities.)⁹

In concluding this preliminary discussion of the re-employment of evacuees, other technical and economic factors which will affect expansion of industrial production in reception areas should be mentioned briefly. First is a minimum functioning of the nation's transportation system, which would be necessary despite the damaged transportation centers in the great cities. Secondly, the industries in reception areas will need more raw materials; if they have sufficient stockpiles at hand they will be less dependent on transportation. Thirdly, the complicated nationwide interdependence of all industries and plants has to be kept functioning by governmental and managerial reorganization -- preferably on the basis of prior planning. The integrated factory, processing an article from raw material to finished

8 This figure is a compromise between the limits of 28 percent and 50 percent noted above.

9 There are many other aspects of wartime employment not directly related to evacuation. These lie outside of the scope of this Project and we must refer the reader to other studies. See, U.S. Department of Labor, Bureau of Employment Security, Manpower and Partial Mobilization (Washington, September, 1951), and A. J. Jaffe and Charles D. Stewart, Manpower Resources and Utilization (New York: John Wiley & Sons, 1951). For example, it is well known that total labor force participation increases in times of emergency, and furthermore there is a shift from nonessential to essential industries.

product, is a rarity. Most industrial units are continuously dependent on many shops and plants to obtain parts, tools, repair services, or consulting services, etc. Attention must therefore be given to keeping a balanced industrial complex going in the undestroyed areas.

These enormous obstacles, however, should not make re-employment and industrial expansion seem impossible. World War II records, particularly from Germany, show how the output in undestroyed facilities can be increased in spite of heavy losses in many target cities. In Great Britain, according to our interviews at the Ministry of Labour, the re-employment of displaced workers in important industries has already been planned in some detail. Lists have been prepared of sites to which firms could move in case their plants have been destroyed. The firm would take the undamaged light equipment and move it together with the workers. It is also recommended in Great Britain that firms in vulnerable areas make arrangements with firms of the same branch in reception areas for the purpose of evacuating the whole unit and expanding production in the dispersed firms. In order to organize the reallocation of evacuated workers, the British plan to use their Employment Exchanges. The role which the U.S. Employment Service could play for the same purpose will be discussed in Chapter VI.

In summary, the re-employment of evacuees evidently must be accomplished in large part by the expansion of existing facilities, because the alternatives -- new construction and employment in agriculture -- will no doubt prove inadequate for the purpose of absorbing very large numbers of evacuees, for the reasons noted in Section A. While the expansion of existing facilities will be accompanied by enormous problems of administration and production, it may be the only practical solution. The study of re-employment in the New York region shows that such methods of expansion can absorb significant numbers of evacuated workers in one major target area.

CHAPTER V

TRANSPORTATION

The vital role of transportation in the life of a nation is obvious. In the modern world, the existence of an industrial society is dependent upon a functioning transportation system. In times of emergency, the crucial nature of transportation becomes apparent. For example, one of the first things to come under strict government control in wartime, if not normally so controlled, is the facilities for transportation. In a mass movement of population such as that entailed in large-scale evacuation, the problems become particularly acute. The purpose of this Chapter is to examine some aspects of wartime transportation with special reference to evacuation.¹

First, the results of a case study of the possible evacuation of children from the New York Metropolitan region are presented. In this study the purpose is to disperse the evacuee population as quickly as possible, with the allocation of evacuees to specific communities ignored for the moment. This provides an estimate of the capacity of transportation facilities to move persons out of the city quickly. Second, we take up the more complicated problem of optimum allocation of evacuees in the available reception areas. Entailed here is an analysis of the criteria which will be utilized, such as cost of transportation, re-employment opportunities in reception communities, etc. Third, a mathematical model for the distribution of evacuees with respect to certain criteria is developed.

A. Evacuation of Children from the New York City Area²

Pre-attack evacuation of special groups (women, children, aged, ill, etc.) from cities threatened by air attack is a civil defense measure (in our classification called Type III Evacuation) endorsed by many. The feasibility of this type of evacuation has

1 The transportation problem in the temporary removal of most inhabitants from a downtown area has been studied in Milwaukee. (Report to Federal Civil Defense Administration prepared by Wilbur Smith and Associates, November, 1954)

2 This phase of the research project was done in consultation with Mr. Nathan Cherniack, Transportation Economist of the Port of New York Authority. Without his intimate knowledge of the highway system of the New York-Northeastern New Jersey areas, the study would not have been possible. The authors are, of course, responsible for the views expressed here.

been demonstrated by the British experience in World War II, when women and children were evacuated from the large cities. But this experience revealed the extremely complex problems that arise in such an operation. One of the major problems, the one concerning us here, is the adequacy of a city's transportation system to move large numbers of people in a limited time.

To reduce the study to manageable proportions, our attention is limited to street and highway transportation. We are interested in the feasibility of moving large numbers of evacuees by private cars and by buses, primarily on a voluntary basis, and without disruption of the important activities of the city. To further delimit the scope of research, only the highway system of the New York-New Jersey metropolitan area was considered.³

While a sample of large cities in the United States would be desirable, our available time and resources did not permit such an extensive investigation. However, research limited to the New York-New Jersey area should be useful, since, first, this metropolitan area is a prime target, and second, such a study should exemplify the methodological procedures and provide certain substantive findings pertinent for planning purposes in other large cities.⁴

It should be mentioned that in making this study we have necessarily ignored a number of complicating factors which will have to be taken into account in actual planning. In concentrating on the highway potential only, we have not considered for the moment the problems of assembling and classifying evacuees, allocation to reception areas, and other practical problems associated with the movement of large populations.

Procedure: The specific assumptions and conditions of this case study are presented below in outline form.

1. Target area.--The five boroughs (counties) of New York City, and Hudson, Bergen, Essex and Passaic Counties in New Jersey, were defined as the areas to be evacuated. This area corresponds roughly to

³ By the New York-New Jersey metropolitan area is meant here the five boroughs (counties) of New York City, and in New Jersey, the counties of Bergen, Essex, Hudson, and Passaic. This area is not to be confused with the "Standard Metropolitan Area," as defined by the Bureau of the Census.

⁴ The history of World War II has demonstrated clearly the ability of transportation systems to perform virtual miracles, even in the face of enormous obstacles, and it is not our aim to belabor this fact. Rather, we are interested in the potential of the New York highway system for accomplishing Type II Evacuation while at the same time permitting the city's economic life to continue.

the New York-Northeastern New Jersey Urbanized Area (as defined by the Bureau of the Census), and to an area enclosed by a 15-mile circle originating at the approximate center of Manhattan.

2. Evacuee population.--All persons 14 years and under in the "target area" are the evacuee population.⁵ In the case of Bergen, Essex, and Passaic Counties in New Jersey, we took only the population 14 years and under which resided in the Urbanized Area of those counties. There were less than 9,000 persons 14 years and under residing outside the Urbanized Area in these three counties.

3. Destination.--The possible destinations were reduced to four general routes, namely: (a) east to Long Island, (b) north to Westchester and upstate New York counties, (c) northwest to northern New Jersey and adjacent New York counties, and (d) southwest to southern and mid New Jersey. (See Figure 1 for a map of the New York-New Jersey target area, and general evacuation directions.) The major points of traffic congestion on these routes determined, in part, the time necessary for the movement.

4. Type of transportation.--The means of transportation were restricted to private autos and to buses. The percentage of the population going by auto and the percentage by bus for a given county were arrived at by analysis of auto registrations and statistics on family size. The number of passengers per vehicle was designated as three persons per auto (excluding the driver)⁶ and thirty per bus. (See Table 12 for number of evacuees by type of transportation by county.)

5. Capacity of transportation facilities.--Data on proved vehicle capacity in two-way traffic for highway facilities (including bridges and tunnels, etc.) which might become bottlenecks were compared with the estimated traffic load on these facilities. It was thus possible to assess the capacity of the highway system with respect to our evacuation problem.

6. Allocation of destination.--The reception areas (or directions of evacuation) were allocated to the different target counties in consideration of their proximity and available facilities.

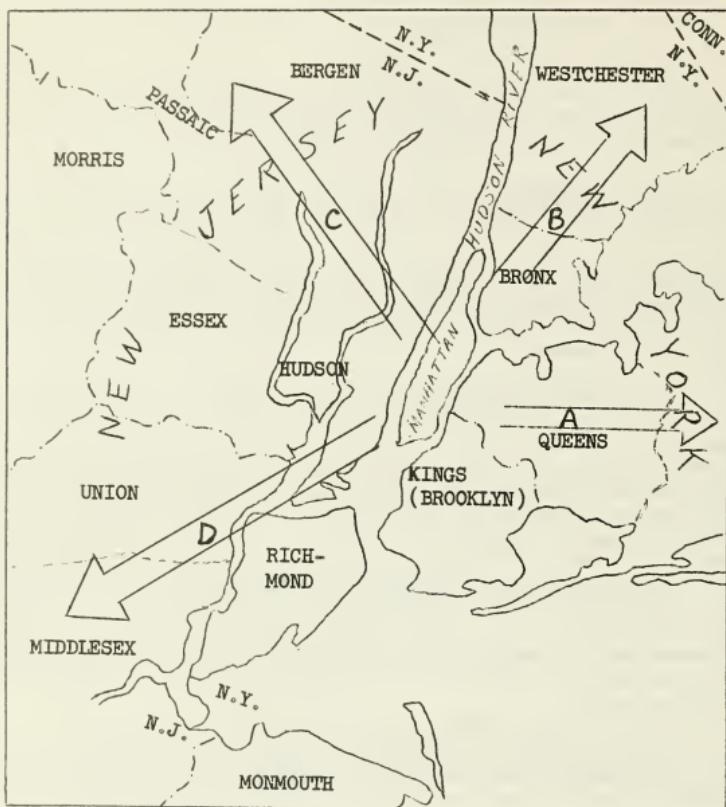
7. Control exercised.--Although the evacuation is conceived of as primarily a voluntary movement, control and direction of the movement, particularly of traffic, by local officials is assumed here. It

5 Adult escorts would, of course, be needed in an actual evacuation.

6 A parent of the children would presumably be the driver for most private cars. If a nonworking mother drives the car she might remain evacuated together with the children.

Figure 1

General Evacuation Routes: New York-New Jersey Metropolitan Area



General Destination	Number of Evacuees	Trips by Auto	Trips by Bus	Total Trips
A Long Island	454,029	63,343	8,800	72,143
B Westchester Upstate N.Y.	589,719	71,423	12,515	83,938
C Northern N.J. Adjacent N.Y.	584,454	118,588	7,623	126,211
D Southern N.J.	538,044	120,368	5,898	126,267
TOTALS	2,166,246	373,723	34,836	408,559

TABLE 12

NUMBER OF EVACUEES AND TYPE OF TRANSPORTATION BY COUNTY

"Target" Counties	Total Evacuees	Evacuees by Auto		Evacuees by Bus	
		Number	Percent	Number	Percent
New York: Bronx Kings Manhattan Queens Richmond	314,993	94,498	30	220,495	70
	614,553	215,094	35	399,459	65
	327,402	81,851	25	245,551	75
	327,402	261,922	80	65,480	20
	46,141	46,141	100
Total New York	1,630,491	699,506	43	930,985	57
New Jersey: Bergen Essex Hudson Passaic	125,840	125,840	100
	196,237	156,990	80	39,247	20
	142,774	85,664	60	57,110	40
	70,902	53,177	75	17,725	25
Total New Jersey	535,753	421,671	79	114,082	21
Total N.Y.-N.J.	2,166,244	1,121,177	52	1,045,067	48

is also assumed that the media of mass communication will cooperate in notifying the public of the details of movement.

Results: The data outlined in the foregoing section permitted us to specify the number of trips by auto and by bus to be routed over the various highways. Total trips and percentages of totals bound for the four general destinations are shown in Figure 1.

Analysis of the highway, bridge, and tunnel capacities showed that the flow of evacuation traffic could be handled in from one to three days without disrupting normal activities of the New York-New Jersey metropolitan area. If the evacuation took place on a Sunday, it could be accomplished during the daylight hours of that day.⁷ If the evacuation began on a Saturday and was carried out during daytime

⁷ All succeeding references to time refer to daylight hours.

only, it could be accomplished with relative ease by Sunday. If done on weekdays, three days would be required because normal commuting would take away a large share of highway facilities.

It should be noted in the interpretation of the results of this study, that our hypothetical conditions have served in several ways to overstate the required transportation. First, the capacity of autos and buses is not fully utilized, thus increasing the total estimated number of trips necessary. Second, only autos and buses are utilized in the operation, leaving untapped the rail and truck capacities. Third, the provision that normal city life is not to be disrupted in the process of movement obviously increases the time needed (this condition includes keeping all highways open to normal two-way traffic flow). Finally, restricting the movement to daylight hours clearly precludes maximum use of the highway system.

Even with these restrictions, however, we have shown that the evacuation could be accomplished in three days, at most. Since this type of evacuation is designed to be used before attack, say, in a period of extreme international tension or aggression in some part of the world, there is reason to believe that such an operation would be practical. Should conditions warrant a more rapid evacuation, the full utilization of all the area's transportation potentialities could significantly reduce the time necessary. It is possible that a well planned scheme, using all available facilities, could accomplish the evacuation in a matter of hours -- at least transporting people outside of the target area and beyond all traffic congestion. A more permanent relocation of evacuees would take longer but would not jeopardize the program.

Transportation by private cars and buses, which was the underlying assumption for these conclusions, is particularly advantageous for the more permanent distribution of evacuees. Railroads have generally a much greater capacity for the movement of large masses from station to station. Automobiles, on the other hand, permit a more discriminate movement of small groups (families, school classes) -- together with their luggage -- from door to door, i.e., from the home in the target city to a particular billet.

Now the foregoing conclusions are not particularly startling when the magnitude of the commuter population handled by the New York-New Jersey transportation system is considered. For example, on a typical business day in 1948, 3,765,000 persons entered Manhattan south of 61st St.⁸ However, our conclusions are more significant when viewed

⁸ Regional Plan Association, Inc., "Persons and Vehicles Entering Manhattan South of 61st Street: 1924-1948," Regional Plan Bulletin, No. 74 (October, 1949), p. 1.

in the light of some rather pessimistic observations that have been made to the effect that the New York-New Jersey area is so utterly vulnerable as to make any evacuation planning fruitless. Our data indicate that such a view is not warranted. Those criticizing evacuation as leading to insoluble traffic problems might more profitably consider the catastrophe that could occur in a target area if no evacuation took place, or give their attention to the enormous problems which will arise in reception areas after the movement is accomplished.

B. Transportation and Distribution of Evacuees According to a Nationwide System

In the preceding section the general problem was to disperse non-essential persons as quickly as possible from a target area, but the final allocation of the evacuees to more permanent reception areas was left for a later stage. There are a great many possible ways of allocating the evacuees from all target cities to the numerous reception areas over the nation. First we must decide on the relevant criteria which shall be used in determining the allocation.

First Criterion: Equalization of housing density.--In Chapter II increases in housing density under different levels of evacuation in all reception areas were computed, assuming an equalized density within the nation. By means of such a nationwide equalization the housing density will be minimized, or in other words, no reception areas will be more crowded than the rest. This criterion tells us how many evacuees each reception area should accommodate under given levels of evacuation; it does not determine to which reception area the evacuees from a given target city should be allocated.

Second Criterion: Minimization of transportation.--A rough method of allocation is to send the evacuees from each target city to those accommodations which lie "closest," since it is desirable that evacuees do not have to travel long distances to reach their final destinations. However, selection of "closest" areas is not a simple task. Let us consider, for example, a reception area in New Jersey about midway between the target cities of New York and Philadelphia. Shall its accommodations be shared by evacuees from both cities, or shall they all be allocated to New York because New York has a much larger number of evacuees than Philadelphia? Similarly, should accommodations in Florida be allocated on the one hand to evacuees from Norfolk, Va. and New Orleans because they are the closest target cities, or on the other hand, should these accommodations be available for evacuees from New York and Washington since accommodations for evacuees from these areas are more difficult to obtain? Such problems indicate the need for a more exact definition of an optimum transportation criterion. Accordingly, the minimization of the total transportation cost of evacuation for the nation as a whole has been chosen.

"Transportation cost" can be determined in passenger-miles, manhours lost for travelling, or some other unit. The next section presents a mathematical technique for a definite solution of this allocation problem on the basis of the first two criteria. Utilizing the criteria of an equalized housing density and a minimized total transportation cost, it can be mathematically determined to which reception area evacuees from each target city should be allocated so as to have an equitable and efficient evacuation. However, there are further important criteria which complicate the picture.

Third Criterion: Matching of occupational skills and employment opportunities.--If workers have to be evacuated (Type III Evacuation) it is important that they find re-employment in the reception area (see Chapter IV). For this purpose it is necessary to allocate the skilled workers to areas which have industrial facilities capable of utilizing their skills. This is one of the most important selection criteria. Hence, a compromise will have to be made with the following results: (1) housing density will not be fully equalized in order that workers may be located in those areas which offer employment opportunities,⁹ and (2) the total transportation cost will not be minimized, because workers with special skills must travel to areas with the appropriate industries.

Fourth Criterion: Matching of host and evacuee.--In Chapter III it was suggested that friction between billeted evacuees and hosts can be reduced by matching evacuees and householders with regard to racial, socio-economic, and perhaps religious characteristics. This matching or adjustment of social characteristics provides a further criterion for an optimal selection of reception areas. It is possible to reconcile this criterion only partially with the first three criteria. The selection of the optimal host-evacuee combination will have to be done largely on an individual basis within the reception area, or at least on the basis of smaller neighborhoods within the larger reception county.

Fifth Criterion: Individual selection of billets.--As stated in Chapter III, billeting with relatives or friends generally leads to the most satisfactory housing arrangements. Our sample survey indicates that about 25 percent of all city dwellers (in a city like New York) would be able to make their own billeting arrangements in this way. This highly desirable criterion of individual billet selection conflicts with the first three criteria mentioned above. It can only be reconciled with the fourth one. Therefore a further compromise is necessary to allow for individual selection of billets with friends or relatives.

⁹ This compromise has already been considered in Chapter II by our separate computations of housing density for Principal Industrial Counties.

C. A Mathematical Technique for Selecting Reception Areas to Minimize Transportation¹⁰

1. Statement of Problem

Given the number of evacuees from all target cities, the housing density in all reception areas can be equalized simply by the method used in Chapter II.¹¹ Having thus obtained the housing density for all reception areas, this density can be multiplied by the number of dwelling units in each reception area to determine the number of accommodations the particular area can offer, or in effect, the number of evacuees it should accommodate.

The second criterion requires that the total travel of all evacuees from target city to reception area be minimized. Its solution involves somewhat more extensive mathematical operations, which are presented below. Transportation cost can be defined as passenger-miles travelled, or a time or cost function for transportation. Under the simple assumption requiring a minimum for the product of people and distances (i.e., passenger-miles) a solution can be found in explicit terms by techniques associated with "linear programming."¹²

2. Notation

The following terminology is employed throughout this paper, in addition to commonly used terms arising from the mathematical operations involved.

m = Number of target cities to be partially evacuated.

¹⁰ This Section was prepared by Dr. Carl Hammer, Senior Research Engineer of the Franklin Institute, Philadelphia 3, Pennsylvania.

¹¹ Add the total number of evacuees to the total resident population of reception areas and divide by the total number of dwelling units in reception areas. The quotient is then the equal (increased) housing density for all reception areas.

¹² It should be added that this technique for minimizing total passenger-miles can also be applied to a situation where the number of accommodations in reception areas has not been determined through the criterion of an equalized housing density, but by some other method instead. For example, if the number of accommodations is defined so that it will not exceed the total number of evacuees, then this minimization technique will work just as well, leaving the accommodations of more remote reception areas empty or only partly filled.

n = Number of reception areas into which the evacuation takes place.

C_i = Number of evacuees from the i -th target city ($i = 1, 2, 3, \dots, m$).

R_j = Number of accommodations (for one person) in the j -th reception area ($j = 1, 2, 3, \dots, n$).

d_{ij} = Distance between the i -th target city and the j -th reception area.

N_{ij} = Number of persons from the i -th target city to be moved and accommodated in the j -th reception area. These are the unknown values to be computed, subject to the minimum condition (3).

When all the evacuees from the i -th target city must be accommodated, we have the following marginal condition:

$$\sum_{j=1}^n N_{ij} = C_i \quad (1)$$

When all the evacuees in the j -th reception area must come from the several target cities:

$$\sum_{i=1}^m N_{ij} = R_j \quad (2)$$

The entire problem may now be expressed in matrix notation. The matrix (d_{ij}) describes the distances between the i -th target city and the j -th reception area. The matrix (N_{ij}) gives the number of evacuees who are moved from the i -th target city to the j -th reception area. Both matrices have exactly $m \times n$ terms written in m rows and n columns. The problem is now to make the sum of all products over evacuees and distances a minimum:

$$\sum_{i=1}^m \sum_{j=1}^n (d_{ij} N_{ij}) = \text{Minimum} = M \quad (3)$$

3. Procedure

Expression (3) which is to be minimized has exactly $m \times n$ terms arranged in matrix form $(d_{ij} \cdot N_{ij})$. The choice of the N_{ij} 's is subject to the $m \neq n$ side conditions (1) and (2). The d_{ij} 's are, of course, given. Therefore, the total number $m \times n$ unknown N_{ij} 's has $mn-m-n = (m-1)(n-1)-1$ degrees of freedom. In addition, the N_{ij} 's must be natural numbers (i.e., positive, whole numbers).

We shall now choose a preliminary trial matrix (N_{ij}) that fulfills side conditions (1) and (2) but not necessarily the minimum condition (3). Then we shall define an operator on this matrix (N_{ij}) whose repeated application will change the N_{ij} values until the minimum condition (3) is fulfilled. However, the operator need be applied only a finite number of times. The operator acts on any of the $mn(m-1)(n-1)/4$ submatrices of size 2×2 which can be obtained by striking out any $m-2$ columns and $n-2$ rows in the original $m \times n$ matrix. Let the elements of these submatrices be:

$$(N) = \begin{pmatrix} N_{i_1 j_1} & N_{i_1 j_2} \\ N_{i_2 j_1} & N_{i_2 j_2} \end{pmatrix} \quad (4)$$

$$(d) = \begin{pmatrix} d_{i_1 j_1} & d_{i_1 j_2} \\ d_{i_2 j_1} & d_{i_2 j_2} \end{pmatrix} \quad (5)$$

It is evident that the minimization of (3) requires that the N_{ij} 's be changed in such a way that the total row sum condition (1) and the total column sum condition (2) are not disturbed. Therefore, we shall require that the operator adds equal terms to the minor diagonal of the submatrix (N) while the same terms are subtracted from the major diagonal of the same submatrix. This procedure leaves row and column sums unchanged. Furthermore, if the expression

$$\Delta = d_{i_1 j_2} \neq d_{i_2 j_2} - d_{i_1 j_2} - d_{i_2 j_1} \quad (6)$$

is positive, the N_{ij} 's must be altered into

$$(N \neq A) = \begin{array}{ccc} N_{i_1 j_1} - A & & N_{i_1 j_2} \neq A \\ & \swarrow \quad \searrow & \\ N_{i_2 j_1} \neq A & & N_{i_2 j_2} - A \end{array} \quad (7)$$

since only then the product sum over the matrix

$$(N_{i_1 j_1} - A) d_{i_1 j_1} \neq (N_{i_2 j_2} - A) d_{i_2 j_2} \neq (N_{i_1 j_2} \neq A) d_{i_1 j_2} \neq (N_{i_2 j_1} \neq A) d_{i_2 j_1}$$

$$= N_{i_1 j_1} d_{i_1 j_1} \neq N_{i_2 j_2} d_{i_2 j_2} \neq N_{i_1 j_2} d_{i_1 j_2} \neq N_{i_2 j_1} d_{i_2 j_1} - A \triangle \quad (8)$$

is reduced in value. Of course, this reduction can only proceed until some of the N_{ij} 's are zero since no entries in the final matrix (N_{ij}) may be negative numbers. If the expression Δ is negative, then A is chosen negative such that one or both $N_{i_1 j_2}$ and $N_{i_2 j_1}$ become zero.

This problem in linear programming is now solved by scanning all possible 2×2 submatrices repeatedly and by applying the correct "local" operators. Each submatrix is reduced until it contains the maximum number of zeros. If any submatrices which have already been reduced are changed during one of the later steps, the process is repeated until all possible submatrices have assumed their respective smallest values. In most cases, the process converges rapidly towards a solution, especially if the choice of the preliminary elements (N_{ij}) is made somewhat judiciously.

4. A Hypothetical Example

Figure 2 represents a hypothetical map designed to illustrate the problem and the steps that lead to its solution. The map shows four target cities and twenty reception areas. Listed below are the

numbers of evacuees and numbers of accommodations.

TABLE A
NUMBER OF EVACUEES
FROM EACH
TARGET CITY

C ₁	=	150,000
C ₂	=	300,000
C ₃	=	250,000
C ₄	=	100,000
Total		800,000

Figure 2

Hypothetical Map of Four Target Cities and Twenty Reception Areas

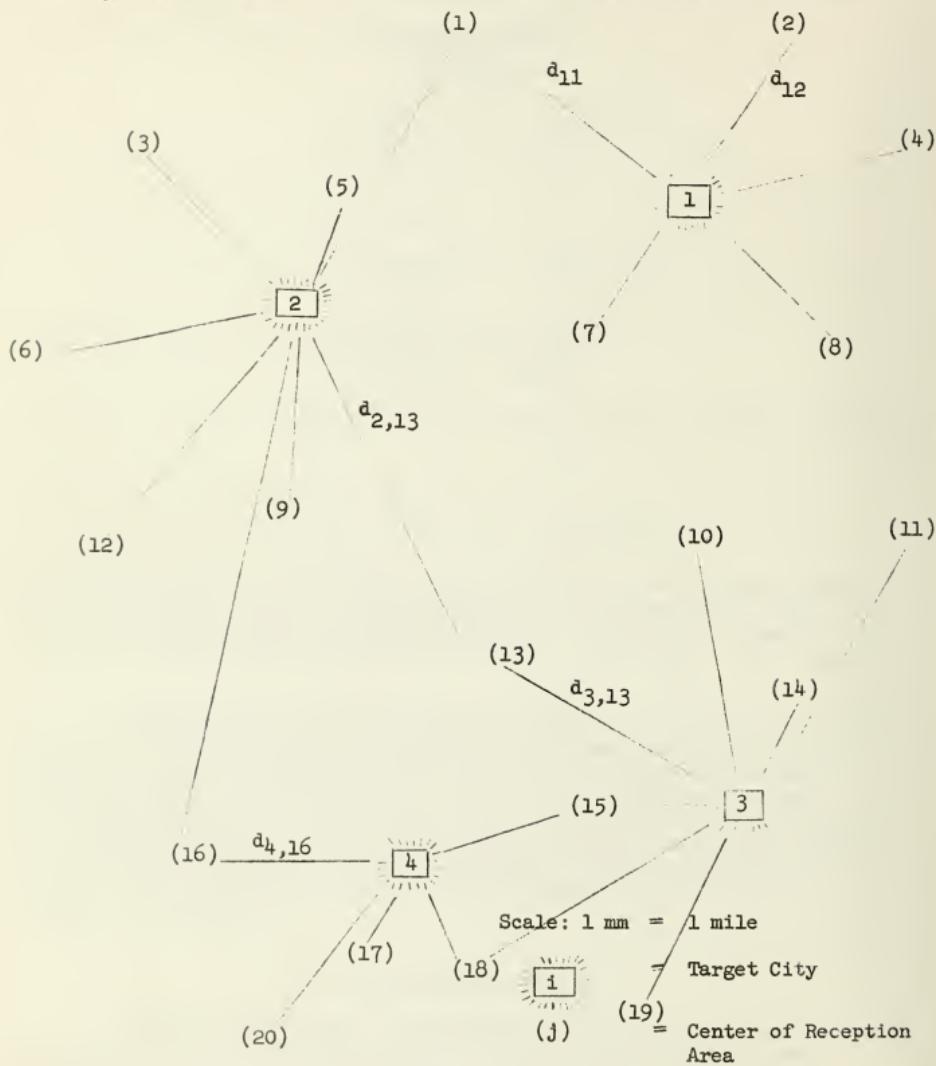


TABLE B
NUMBER OF ACCOMMODATIONS

$R_1 = 25,000$	$R_{11} = 45,000$
$R_2 = 40,000$	$R_{12} = 35,000$
$R_3 = 55,000$	$R_{13} = 50,000$
$R_4 = 15,000$	$R_{14} = 40,000$
$R_5 = 50,000$	$R_{15} = 50,000$
$R_6 = 60,000$	$R_{16} = 60,000$
$R_7 = 45,000$	$R_{17} = 20,000$
$R_8 = 35,000$	$R_{18} = 40,000$
$R_9 = 20,000$	$R_{19} = 55,000$
$R_{10} = 30,000$	$R_{20} = 30,000$
<u>Total</u> 800,000	

The distances between the target cities and the centers of reception areas, taken from Figure 2 to the nearest five miles, vary from 40 miles to 360 miles. These distances are shown in matrix form in Table C.

TABLE C
MATRIX OF DISTANCES (d_{ij}), (MILES) BETWEEN FOUR TARGET CITIES
AND TWENTY RECEPTION AREAS

Rec. ar.	j=1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
City i=1	50	35	100	40	60	125	35	40	90	60	70	130	90	90	110	150	155	145	150	180
2	60	105	45	115	20	50	50	100	40	80	115	65	65	115	105	100	120	125	145	140
3	150	140	165	125	130	150	85	80	95	50	60	125	60	20	30	100	80	60	45	105
4	150	165	140	155	120	115	95	120	60	80	110	80	40	75	30	40	20	20	50	50

We can use an arithmetical approximation to simplify the numerical task. Suppose we are satisfied with a solution to the nearest 5000 people for each reception area; it is then sufficient to write all numbers in multiples of 5000, as shown in Table D.

TABLE D

REDUCED VALUES OF C_i AND R_j

$C_1 = 30$	$R_1 = 5$	$R_6 = 12$	$R_{11} = 9$	$R_{16} = 12$
$C_2 = 60$	$R_2 = 8$	$R_7 = 9$	$R_{12} = 7$	$R_{17} = 4$
$C_3 = 50$	$R_3 = 11$	$R_8 = 7$	$R_{13} = 10$	$R_{18} = 8$
$C_4 = 20$	$R_4 = 13$	$R_9 = 4$	$R_{14} = 8$	$R_{19} = 11$
	<u>$R_5 = 10$</u>	<u>$R_{10} = 6$</u>	<u>$R_{15} = 10$</u>	<u>$R_{20} = 6$</u>
$C = 160$				$R = 160$

Similarly, the distances can be coded in multiples of five if we are content with an accuracy of five miles. The reduced distance matrix appears then as follows:

TABLE E

REDUCED DISTANCES (d_{ij})

j\i	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
i = 1	10	7	20	8	12	25	7	8	18	12	14	26	18	18	22	30	31	29	30	36
2	12	21	9	23	4	10	10	20	8	16	23	13	13	23	21	20	24	25	29	28
3	30	28	33	25	26	30	17	16	19	10	12	25	12	4	6	20	16	12	9	21
4	30	33	28	31	24	23	19	24	12	16	22	16	8	15	6	8	4	4	10	10

The desired distribution matrix (N_{ij}) which satisfies the minimum condition (3) will now be obtained by the method described earlier. We shall show two different ways to start the problem, the second more sophisticated than the first. Both lead to the same solution.

a. Elementary procedure.--The matrix (N_{ij}) in its natural or reduced form must fulfill boundary conditions (1) and (2). Therefore, we may write down arbitrary positive numbers which meet the boundary conditions without regard to the "weights" imposed by the distances d_{ij} . If the numbers at first do not match all boundary conditions they can easily be adjusted in a few places. The large number of degrees of freedom makes this an easy task. Thus we may write down the following trial matrix, shown as Step (1) in Table F. The boundary conditions are fulfilled, as shown by column and row sums.

TABLE F

TRIAL MATRIX (N_{ij}), Step (1)

		j=1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Sums = C_i
i =		1	1	2	0	2	2	2	1	1	1	1	2	1	2	1	2	3	1	2	2	1
1	1	1	2	0	2	2	2	1	1	1	1	2	1	2	1	2	3	1	2	2	1	30
2	2	4	4	1	4	4	3	3	2	2	3	3	4	3	4	4	4	1	3	4	2	60
3	1	2	4	2	3	3	3	2	1	2	3	2	3	3	3	4	1	2	4	2		50
4	1	1	1	0	1	3	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	20
Sums =																						
	R_j	5	8	11	3	10	12	9	7	4	6	9	7	10	8	10	12	4	8	11	6	160

Now we focus our attention on the two columns on the left of this matrix and compare them with the columns of the reduced distance matrix, Table E. The upper left corner of the trial matrix is the submatrix $\begin{pmatrix} 1 & 1 \\ 2 & 4 \end{pmatrix}$.

It requires $1 \times 10 + 1 \times 7 + 2 \times 12 + 4 \times 21 = 125$ passenger miles "transportation cost." The operator $\Delta - 10 + 21 - 7 - 12 = 12$, is positive. Therefore, the transportation cost due to this submatrix is reduced if we increase the entries in its minor diagonal and decrease the entries in its major diagonal by the same amounts. But the major diagonal can only suffer a decrease of one unit and the minor diagonal will accordingly be increased by one unit. This changes the submatrix $\begin{pmatrix} 1 & 1 \\ 2 & 4 \end{pmatrix}$ into $\begin{pmatrix} 0 & 2 \\ 3 & 3 \end{pmatrix}$ and reduces the relocation cost over the submatrix

from 125 to 113 "converted" passenger-miles. Step (1) and Step (2) in Table G show how the trial matrix (of Table F) changes in its two columns on the left as a result of this reduction in the first submatrix. The effect of the operator in any 2×2 submatrix is to "load up" the "weak" diagonal and to "unload" the "strong" diagonal, thus reducing the total relocation cost in terms of passenger-miles.

TABLE G
ADDITIONAL STEPS TAKEN TOWARD MINIMIZATION IN TRIAL MATRIX

<u>Step (1)</u>	<u>Step (2)</u>	<u>Step (3)</u>	<u>Step (4)</u>
1 1 .	0 2 .	0 2 .	0 2 .
2 4 .	3 3 .	4 2 .	5 1 .
1 2 .	1 2 .	0 3 .	0 3 .
1 1 .	1 1 .	1 1 .	0 2 .

Table G contains two additional steps that can be taken with the first two columns. Step (3) involves the elements in the second and third row; the major diagonal of this submatrix has to be increased because the sum of distances ($12 + 28$) is less than the sum of distances ($30 + 21$) of the minor diagonal (see Table E). Only a change of one unit can be made since negative entries in the submatrix are not permissible. Thus, the submatrix $\begin{pmatrix} 3 & 3 \\ 1 & 2 \end{pmatrix}$ changes into $\begin{pmatrix} 4 & 2 \\ 1 & 2 \end{pmatrix}$. Step (4), finally changes the submatrix $\begin{pmatrix} 4 & 2 \\ 1 & 1 \end{pmatrix}$ of the second and fourth row into $\begin{pmatrix} 5 & 1 \\ 0 & 2 \end{pmatrix}$.

These steps reduce the number of converted passenger-miles for the first two columns of the original trial matrix from 274 to 245; this is the smallest value which can be obtained with these two columns alone. In other words, minimum condition (3) is now met by the first two columns, but not yet by the other eighteen columns. Had the problem involved only four cities and first two relocation centers, the solution obtained thus far would be the desired minimum solution. Three tests can be made to prove that up to now this is the minimum solution -- the single entry 5 in the first column can be combined with entries 2, 3, or 2 from the second column. Neither combination allows a further reduction of the total passenger-miles for the first two columns. Hence, we have reached a temporary halt in the application of the operator.

To continue the work on our trial matrix, we must evidently introduce additional columns as we go along. Table H shows the steps that result from bringing the third column from Table F into interplay with the first two reduced columns until no further reductions with the previously defined operator are possible.

TABLE H
FURTHER STEPS TAKEN TOWARD MINIMIZATION IN THE TRIAL MATRIX

<u>Step (5)</u>	<u>Step (6)</u>	<u>Step (7)</u>	<u>Step (8)</u>	<u>Step (9)</u>
0 2 2 .	0 3 1 .	0 4 0 .	0 4 0 .	0 4 0 .
5 1 4 .	5 0 5 .	5 0 5 .	5 0 5 .	2 0 8 .
0 3 4 .	0 3 4 .	0 2 5 .	0 4 3 .	0 4 3 .
0 2 1 .	0 2 1 .	0 2 1 .	0 0 3 .	3 0 0 .

Again we have reached an impasse; the sum of passenger-miles for the reduced 4×3 matrix is now 425 against 510 in the first three columns of the trial matrix of Table F. The following steps are shown in Table J. They lead to minimum solutions for increasingly larger sections of the original trial matrix.

TABLE J
ADDITIONAL STEPS TAKEN TOWARD MINIMIZATION IN THE TRIAL MATRIX

<u>Step (10)</u>	<u>Step (11)</u>	<u>Step (12)</u>	<u>Step (13)</u>	<u>Step (14)</u>	<u>Step (15)</u>
0 4 0 0 .	0 4 0 0 .	0 4 0 0 2 .	0 4 0 0 2 .	0 4 0 0 2 .	0 4 0 0 2 2 .
2 0 8 1 .	0 0 1 0 1 .	0 0 1 1 0 4 .	0 0 1 1 0 4 .	0 0 7 0 8 .	0 0 7 0 8 4 .
0 4 3 2 .	2 4 1 2 .	2 4 0 3 3 .	5 4 0 3 0 .	5 4 0 3 0 .	5 4 0 3 0 3 .
3 0 0 0 .	3 0 0 0 .	3 0 0 0 1 .	0 0 0 0 4 .	0 0 4 0 0 .	0 0 4 0 0 3 .

By now it has become clear that the elementary procedure chosen to demonstrate the operator method is rather cumbersome. However, if pursued

diligently, it leads to the required minimum solution regardless of our choice for a trial matrix. No matter what the entries in the trial matrix are, the final minimized result will be the same. In the next section, we will start off with a trial matrix whose entries are chosen more judiciously than the rather arbitrary entries of Table F, and then reach the final solution more quickly than we could have reached it with the elementary procedure.

b. A more advanced procedure.--Inspection of the reduced values in Table J shows that many non-zero entries in the fifteenth step now appear in those positions where the columnar d-values (Table E) are smallest. This is a clue, and we reason that it is advantageous to place as many people as possible into lines of shortest travel. The reduced matrix (d_{ij}) , Table E, holds some smallest distance d in every column; the trial matrix shall now be started by preferring these positions over all others. In some instances, we can satisfy the column marginal conditions by placing the entire column-sum into the one position with least travel distance. In other instances, we must split the column-sums into components to meet the row-sum conditions as well. Such a start may lead to the following, more sophisticated trial matrix (N_{ij}) , shown as Step (1):

TABLE K

ADVANCED TRIAL MATRIX (N_{ij}) , STEP (1): UNADJUSTED ROW SUMS

	j=1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Sums
i=1	5	8	3		9	7															32
2				11	10	12		4												44	
3							6	9		10	8	10						11		54	
4													12	4	8		6				30
Sums	5	8	11	3	10	12	9	7	4	6	9	7	10	8	10	12	4	8	11	6	160

First, we must adjust the row sums; Step (2):

TABLE L

ADVANCED TRIAL MATRIX (N_{ij}) : ADJUSTED ROW SUMS

	j=1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Sums
i = 1	5	8	3			7	7														30
2		11		10	12	2		4			7	4			10						60
3								6	9		6	8	10				11				50
4											2	4	8					6			20
Sums	5	8	11	3	10	12	9	7	4	6	9	7	10	8	10	12	4	8	11	6	160

Application of the operator to the first and seventh column yields the following Step (3):

TABLE M

ADVANCED TRIAL MATRIX (N_{ij}), STEP (3)

	j=1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Sums
i = 1	3	8	3			9	7														30
2	2	11		10	12		4			7	4			10							60
3								6	9		6	8	10				11				50
4											2	4	8					6			20
Sums	5	8	11	3	10	12	9	7	4	6	9	7	10	8	10	12	4	8	11	6	160

Further application of the operator yields eventually the matrix of Table N for which the sum of all products over evacuees and distances, $M = 1424$, is a minimum in reduced units:

TABLE N

FINAL REDUCED MATRIX (N_{ij}) WITH MINIMUM CONDITION (3)

	j=1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Sums
i=1	3	8	3		9	7															30
2	2	11	10	12			4		7	10				4							60
3					6	9			8	10			6	11							50
4									8	10	12	4	8	11	6						20
Sums	5	8	11	3	10	12	9	7	4	6	9	7	10	8	10	12	4	8	11	6	160

Multiplication of the entries in Table N by the earlier introduced reduction factor of 5000 will yield the desired solution in actual numbers of evacuated persons; multiplication of the final M by the two reduction factors of 5 (miles) and 5000 (persons) yields the minimum number of 35,600,000 passenger-miles needed to effect the relocation of the 160,000 evacuees from the four cities.

5. Extensions of the Method of Solution

The operator method chosen here to solve this problem in linear programming is purely analytical, i.e., it is a paper-and-pencil method. However, a prime requirement for this problem is speed. The solution for a country with almost a hundred target cities, many hundreds of reception areas, and millions of evacuees must be found quickly if it is to be of effective value. Furthermore, after a solution has been worked out, lines of communication may be interrupted or the evacuation of cities may be desirable in only a part of the country. Some thought should now be given to a type of solution that is obtained easily and rapidly, and that permits an instantaneous change of the input quantities.

First of all, we may make use of properly programmed high-speed digital computing machines which are capable of producing the solution in a very short time, possibly in a matter of one hour or less. The capacity of such machines permits the storage of all the required data. Changes in the transportation facilities or in the number of evacuees are made by a "write-over" in the storage input. The machine holds the stored program and presents the solution in printout form. UNIVAC, ERA 1103, IBM 701 and other systems are perfectly capable of handling

this kind of problem. Secondly, we may use analog devices which can give the solution to the problem in a more dramatic form. The analog computer could be built to reflect the map of the country with connections over the lines of transportation. If a transportation line is destroyed, or a reception area is decommissioned, the device will give at once a new solution through output meters or indicators. An analog device which will solve this particular problem of linear programming is likely to contain a large number of units.¹³

As mentioned in Section B, the mathematical model we developed takes into account only two of the several possible criteria of allocation of evacuees. In actual planning a major problem will be the compromises that have to be made in view of criteria with conflicting elements. Once decisions concerning compromises have been made they can be formulated quantitatively and the optimum distribution of evacuees in these terms becomes amenable to mathematical treatment, with all its advantages of speed and accuracy.

6. Supplementary Bibliography

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4. Cooper, W.W., and Charnes, A., Scientific American, Vol. 191(2), 21 (1954).

¹³ A sketch for one such basic unit has been prepared by Mr. W. C. Reisner of the Franklin Institute, Philadelphia, and is available from the authors upon request.

CHAPTER VI

OTHER PROBLEMS OF EVACUATION

The purpose of this Chapter is to make brief mention of other important aspects of evacuation not treated elsewhere in a systematic and comprehensive way because they lie outside our field of specialization or have not been undertaken owing to our resources.

A. Conflicts in Administrative Jurisdiction

The administrative tasks involved in evacuation are greatly complicated by boundaries of local government. All types of evacuation will involve the movement of persons across state, county, or city government boundaries, and especially is this true in long range evacuation of both essential and nonessential personnel (Type III). For example, the number of persons moved from the jurisdiction of their local governments will be large when it is necessary to shift essential workers and to equalize the pressure on housing in reception communities. In effect, large numbers of people will be, in a local government sense, "stateless."¹

This mass movement complicates administration on two levels. At the local level there are the problems of jurisdiction and financial responsibility for government services rendered to the nonresident evacuees in reception communities. At the national level, there is the conflict between various federal and other agencies which are concerned with different administrative aspects of evacuation. The local jurisdictional problem is one stemming from the collision between the principle of local responsibility and the need for social and economic aid on a national scale.² This issue proved to be serious in Great Britain, where it was found that the success or failure of a given policy was in large part determined by the manner in which jurisdiction was established.³ Evidently the issue was never faced squarely, for the familiar bureaucratic procedures went on apace. According to Titmuss,

...The vast majority of jurisdictional problems⁷ had to be postulated, argued about, minuted on and judicially weighed against a background of relevant facts, precedents, and legal interpretation. These processes, which required of officials an enduring patience and an attitude of abstract

¹ Cf. Margaret Cole, "Wartime Billeting," Research Series No. 55, issued by the Fabian Society, London (May, 1941), p. 24.

² For a fuller discussion of this point as it applies to the English scene, see Titmuss, op. cit., p. 235.

³ Ibid., pp. 203 ff.

detachment from the troubles of man, also called forth and nourished a flair for detective paper-work and capacity for memorizing the minutiae of precedent books and legislative enactments.⁴

The second problem concerns the question of which national agency or agencies are to be responsible for evacuation. This was faced by Great Britain, particularly in the early phases of World War II when there was evidently no clear-cut designation of responsibility among the major departments of the British National government. According to Cole,

... No fewer than ten Departments -- the War Office, the Admiralty, the Air Ministry, the Ministry of Health, the Board of Education, the Ministry of Labour, the Ministry of Supply, the Ministry of Works and Buildings, the Ministry of Aircraft Production, and Ministry of Home Security -- are concerned with the housing of persons away from their homes; and there is no power which can force them to agree.⁵

The major sources of conflict in Great Britain arose over whether evacuees (the responsibility of the Ministry of Health) or the military should receive priority in billeting. The military authorities were a major drain on available housing. As Cole put it,

In practice, the military authorities, possessed of historic prestige, loud voices, and uniforms, generally came first and the civilians a bad second; and even if it be granted that the Army as a whole has first claim -- though even that is not so unquestioned in a mechanised, totalitarian war -- it does not follow at all that the local representative of the War Office is best qualified to judge what accommodation should be reserved for his men and what left for the un-uniformed rabble.⁶

The interdepartmental confusion and conflict between the Ministry of Health and the Military led Cole to plea for centralized control of billeting. This author maintained that, "...the Central Billeting Authority must have sufficient power and determination to stand up to the Service Departments and to treat them, as they should be treated, as part only of a concerted national effort."⁷ It is likely that similar conflicts

⁴ Ibid., p. 208; see also pp. 150-170.

⁵ Cole, op. cit., pp. 10-13.

⁶ Ibid., p. 13. See also Shakespeare, op. cit., p. 8 for an essentially similar view.

⁷ Cole, op. cit., p. 13.

between federal agencies would occur in the United States in case of evacuation.

We are not in a position to recommend as have some authorities in Great Britain, that traditional forms of local government should be modified in an emergency so as to prevent jurisdictional confusion, or to recommend that a strong central authority should be set up to eliminate conflict in the governmental structure. However, the evidence obtained from the experience of other countries does suggest the need for an intensive examination of the administrative procedures necessary for evacuation.

B. Use of Existing Organizations

The possibility of administrative conflict between agencies should not preclude the utilization of existing private or governmental organizations for the implementation of evacuation plans. A functioning organization, with its physical plant and its skilled personnel will certainly prove invaluable in the event of large-scale evacuation. By way of example, we shall mention only a few such organizations as having outstanding importance in the actual operation of evacuation.⁸

1. Bureau of Employment Security.--Among other things, this organization is charged with the administration of the Employment Service (formerly the United States Employment Service). Through affiliated regional state and local offices, this Bureau is in a position to serve the entire country.⁹ The vital role played by the Bureau in World War II is well known. By virtue of its "grass roots" coverage, the Bureau was able to assist, as no other organization could, in the solution of manpower problems on a national scale. Its role in the event of evacuation both of essential and nonessential persons will be even more important. For the efficient use of the nation's manpower in the event of nuclear war will be complicated by the actual destruction of productive facilities

⁸ We are aware that the Federal Civil Defense Administration is required by law (Public Law 875--81st Congress) to cooperate with certain other federal and private organizations, and that in some cases detailed plans for cooperation have been formulated. However, since evacuation has only recently become a firm federal policy, it is likely that cooperation for this specific purpose is as yet in a preliminary state.

⁹ There are approximately 1,797 local public employment offices, and 2,067 "itinerant points." Many of these are located outside of highly vulnerable target cities.

and by casualties in the labor force.¹⁰

2. Religious and Charitable Organizations.--The role of the clergy and such organizations as the Red Cross and Salvation Army in disasters, is so well known as to need no elaboration here. Probably the major difficulty in the utilization of these bodies arises with reference to their integration within the overall administrative evacuation program. In the past, frequent instances of competition between organizations, particularly between charitable organizations, have occurred in disaster work. In the event of large-scale evacuation there will obviously be little room for such competition, and the machinery might well be set up in advance to see that it is avoided.

C. Financial Assistance to Evacuees

In an emergency situation a great many people will be without money either because their homes were destroyed or because they are unable to receive their customary pay checks. Considerations of economy should be of secondary importance in the event of large wartime disasters. Little will be gained by having a complicated system for financial relief which will require a great deal of administrative work and which will probably break down altogether in an emergency. In view of the matters which are at stake, a generous and simple relief policy is more important than saving comparatively minor government expenditures. Obviously, the need for relief will be on such a scale that it can only be met by the Federal government.

In the early years of World War II the British government gave no compensation to evacuees if they found billets with relatives or friends. Since billeting with relatives or friends is particularly desirable from a social point of view, it should be encouraged by the government and compensation should not be withheld.

In Britain's postwar evacuation planning, government aid to private evacuees constitutes a fundamental part of the entire program. This aid will take the form of free travel vouchers and billeting allowances to be available to all members of the priority nonessential classes. A special provision is made to allow mothers with children under five to take also their children of school age in order to keep families together. According to the latest British evacuation manual "such private arrangements will be given every encouragement, for not only do they avoid the separation of school children from their mothers but they enable families leaving home to know their destination in advance and to have the greater

¹⁰ Considerable work has already been done on the use of Bureau of Employment Security facilities in the event of attack on the United States. Of particular interest is the Post Attack Industrial Rehabilitation (PAIR) program.

comfort of staying with friends or relatives instead of in a strange household."¹¹

In addition to the need for financial assistance to cover transportation costs to reception areas and expenses, there will be a need for some compensation for the losses suffered through destruction. Financial losses from the destruction of homes can be so enormous for the nation as a whole that full compensation by the government is out of question; but some compensation is better than none at all.

In World War II the morale of air-raid victims evidently suffered if compensation for lost property was delayed by cumbersome administrative procedures. Thus, there should be a quick and simple way for the claimants to obtain at least a minimum compensation.

After the 1953 floods in Holland, the Dutch Government made generous provisions to compensate for the property losses of the flood victims. The value of lost property was estimated from the pieces of furniture or equipment lost, allowing for different values according to the economic status of the owner. Thus, it was assumed a flood victim of higher economic status owned more valuable furniture and hence was entitled to a somewhat higher compensation per piece lost.

There are many other highly important aspects of evacuation in addition to those mentioned above, which lie outside the province of this Project. By mentioning briefly certain of the most important ones, we merely wish to emphasize that the mainly social aspects dealt with in this report are only part of an overall evacuation plan. The manuals and civil defense literature on evacuation will indicate to the reader further problem areas and suggested solutions.

¹¹ Great Britain, Home Office, Civil Defense Manual of Basic Training. Vol. 1. Welfare Section (London, 1951), p. 16. On the value of accommodations with relatives or friends see Chapter III.

CHAPTER VII

CONCLUSIONS

This Chapter presents the major implications of the research for evacuation planning in a summary form. Where recommendations are made, it must be borne in mind that a large part of the data was gathered from other countries with direct experience in evacuation. While many of these data appear to be relevant for evacuation in the United States, caution must be used in their interpretation. The fact must be recognized that the United States has had no first hand experience with large-scale evacuation. Therefore advance planning should allow for improvisations on a trial and error basis. In this report we have supplied data on some significant social problems involved in evacuation. In addition we have throughout the report, particularly in Chapter VI, mentioned other important aspects which need investigation, but which we could note only briefly. However, it should be obvious that we could not deal with all the many administrative and technical aspects of evacuation.

In the opening remarks to the report it was pointed out that evacuation is a general term which includes several types of population movements. The failure to recognize this has resulted in much unnecessary confusion regarding the feasibility of evacuation as a civil defense measure. In an attempt to clarify the concept we distinguished three major types of evacuation:

- I. Temporary removal of most inhabitants.
- II. Long-term removal of nonessential persons (women, children, etc.).
- III. Long-term removal of both essential and nonessential persons.

The first type, predicated on sufficient warning time, is for the purpose of clearing target cities for the duration of attack or threat of attack. Until recently, most civil defense plans included only this measure. Insofar as the realities of nuclear destruction are not taken into account, this type of evacuation is inadequate. First, it may well be that there will not remain sufficient undestroyed housing to accommodate the dispersed population upon return to the city. Second, repeated attacks would make a more permanent type of evacuation necessary. However, in case of a sudden, initial attack which is, of course, a distinct possibility for the United States -- the first type of evacuation is indicated.¹

¹ Recently actual tests (walkouts) have been made of this measure in several cities, evidently with some success according to press reports.

Evacuation of the second type -- long range removal of nonessential persons (women, children, etc.) from areas threatened by attack -- serves to protect segments of vulnerable populations in periods of international tension when the threat of attack is not great enough to warrant the movement of essential members of the labor force. That this evacuation is feasible is shown by the British experience, where women and children were moved out of target cities and settled in reception communities on a large scale. Its feasibility in the United States with regard to the transportation involved is illustrated by the results of our case study on evacuation of children from the New York City area (Chapter V). This study showed that 90 per cent of New York's children could be evacuated within a period of from one to three days by using only automobiles and buses, and that this could be accomplished with a minimum disruption of the activities of the city. It was concluded that the major problems of such a movement would be conditions in the reception areas, rather than in the availability and organization of transportation facilities.

Type III evacuation -- long range removal of both essential and nonessential persons -- is the primary concern of this research. As previously noted, if destruction is sufficiently great or attacks appear to be imminent it may become desirable to remove even members of the labor force. Opponents of this type of evacuation have argued that it would be impractical because it involves the depopulation, and hence partial immobilization of large urban centers, with their vital role in the national economy. In this report it was fully agreed that cities should not be imprudently abandoned, and there is little reason to fear that this would happen. The point is that there may be no choice in the matter.

It is reasonable to conclude that, on the basis of estimates of the destructive blast and heat effects of nuclear weapons, and of the attack potential of the U.S.S.R., this drastic measure may have to be initiated in the event of war. However, in view of the danger that there might be widespread radioactive fallout any type of evacuation must be combined with a shelter and monitoring program to protect the evacuees against residual radioactivity.

Thus, we have proceeded in this research on the premise that evacuation, particularly of Type III, is a necessary civil defense measure. On this basis we have attempted to show the feasibility of large-scale evacuation and have investigated what appeared to be certain of the more important social problems to be considered. Our major conclusions are summarized below.

1. Housing

The evacuees moved from the cities to safer areas -- the reception areas -- would first of all need food and housing. The provision of food is largely a problem of transportation and distribution, since the primary sources of food lie mainly in rural areas. Accordingly, the feeding

of evacuees has not been dealt with in this report for it is not so much a social question.

Housing, however, involves several social problems. Any proposed solution for the housing of evacuees must be considered within the context of a nuclear war in which the whole country is involved. This naturally, precludes many solutions which would be feasible for a localized natural disaster. The idea that all or most evacuees could be housed in newly constructed emergency dwellings is evidently out of the question in the event of an all out war. Building material and labor would not be available to construct enough new dwellings, for the entire construction industry would be tied up in emergency repairs and urgent defense installations.

Hence, the evacuees will have to be housed in existing buildings. Vacant dwellings, resort hotels, tourist homes and similar facilities should obviously be utilized to their fullest capacity, but would absorb only a very small percentage of all evacuees. The rest will have to be billeted either in mass shelters or in private homes. Both of these alternatives entail social disadvantages, but wartime experience as well as other considerations make it plain that the disadvantages of mass shelters are infinitely greater than those of billeting in private homes.

Mass shelters, such as movie theatres, convention halls, tents, etc., will be useful as collection and rest centers for the first night or two, but a prolonged stay of evacuees would lead to most unsatisfactory conditions. By far the most important form of housing for Type II and Type III evacuation is billeting in private homes. Through an increase in the number of persons per dwelling, evacuees can be accommodated in the private housing existing in reception areas. The size of this increase depends on the total number of evacuees, on the way in which they are distributed, and on the number of dwellings in reception areas. Given some estimates as to which cities would become targets, it is a simple procedure to compute the increase in housing density in the reception areas which would result from any given number of evacuees, under the provision that the housing density shall increase to the same level in all reception areas.²

Using the Federal Civil Defense Administration listing of potential target areas, and with the provision that an equalized housing density will be maintained, we computed the increase in housing density which

2 Other methods of distributing the evacuees are, of course, possible. Alternative methods that have been considered in this report were: (1) an equal distribution within a region only, instead of within the whole country; and (2) a greater concentration of evacuees in industrial reception areas which offer employment opportunities.

would result in reception areas from a given number of evacuees (see Chapter II). In general, the data on American housing showed that the increases in housing densities due to different levels of evacuation (65 per cent and 40 per cent evacuation of all target cities), and to the utilization of different types of reception areas (industrial and non-industrial) lie within the range experienced in Western European cities during World War II (Eastern European and Oriental cities have densities still higher, even in peacetime). Hence, it is not to be expected that the crowded housing conditions arising in reception areas will in themselves have serious repercussions, such as persistent absenteeism in industry, open resistance by the householders in reception areas, or health hazards. The unavoidable crowding will, of course, add to all the other deprivations which the population must suffer in a nuclear war.

2. Interpersonal Relations and Billeting

The experience and research of other countries indicates clearly the inevitability of interpersonal tensions in a billeting situation of any appreciable time span. The research on the Dutch evacuation after the floods in 1953 shows, moreover, that these tensions increase significantly with time. The matching of hosts and evacuees with respect to social, economic, and cultural characteristics tends to reduce the incidence of tensions. However, it is not known with any degree of certainty which characteristics are most important for matching purposes, thus making it impossible to formulate systematic procedures for matching of hosts and evacuees.

In view of the ignorance concerning principles of matching, it appears that one of the best means of reducing billeting failures due to interpersonal tensions is for the evacuee to make his own arrangements for accommodations with friends or relatives in nontarget areas (see Chapter III, Section B).

The survey of the New York metropolitan area showed that a substantial number of persons (about 25 per cent of the total sample) could make their own arrangements for accommodations in reception areas. Moreover, it is likely that many more persons could make their own arrangements should the probability of attack become higher.

3. Re-employment of Evacuees

In Type III evacuation, where workers also have to leave the large cities, it is of paramount importance for the nation that the manpower represented by these workers not be entirely lost. Of the various theoretical possibilities for the re-employment of evacuated workers, employment at existing facilities in reception areas will be numerically of greatest importance. These facilities can utilize the manpower of evacuees by introducing additional shifts or through some other increase in labor. For the industrial region surrounding New York City, for example, we estimated that with plans for maximum employment the manpower of approximately 250,000

"essential" evacuated workers from New York City could be utilized. Similar expansions could, of course, be made in other industrial reception areas of the nation.

The re-integration of evacuated workers requires great feats of administration and production management. Workers have to be allocated to reception areas which contain industries commensurate with their skills. A federal agency like the U.S. Bureau of Employment Security -- with its experience in wartime labor problems -- could no doubt best cope with the organization and coordination of the re-employment. Since the exchange between target cities and reception areas has to take place on a nationwide basis, state and local civil defense agencies are not equipped to handle this problem without strong federal coordination.

4. Transportation and Distribution of Evacuees

Transportation and distribution of evacuees has to achieve two purposes, an immediate and a long-range one. The immediate purpose is the very goal of evacuation itself -- to remove people from target areas to safer areas. Here, speed is of primary importance. A great deal can be achieved with the existing means of transportation alone by detailed traffic planning and proper instructions to the population, as was shown by our study of evacuation of children from New York City.

The long-range purpose of the distribution of evacuees is to settle them in the reception areas in such a way that the following four criteria will be considered: (1) workers should be located near employment opportunities, (2) the housing potential should be utilized so as to minimize crowding, (3) the evacuees should find billets with hosts where social friction is least likely to develop, and finally (4) the total transportation cost (time loss, gasoline, etc.) for moving all evacuees to their respective reception areas should be as small as possible. It is not possible to design a transportation and distribution scheme which would make all of these criteria optimal. For example, the provision that overcrowding should be minimized may conflict with the provision that evacuees should be located near employment opportunities. Compromises must therefore be made.

As an exploratory step we have presented a mathematical technique which allocates the evacuees from all target cities to all reception areas in such a way that the criteria of optimal housing (an equalized housing density) and minimal transportation cost are fulfilled. This technique could be further developed and refined to take account of a combination of all important criteria once decisions regarding compromises are made.

5. Administration

The experience of Great Britain with evacuation in World War II indicates that serious issues of administration arose due to the jurisdictional conflicts at various levels of government (Chapter VI). First,

the need for immediate social and economic aid on a national scale conflicted with the principle of local political autonomy. Second, several branches of the central government were in competition for the available housing in reception areas. The result was in many cases utter confusion and an unnecessary waste of time and resources.

While considerable legislation and planning for intragovernmental and intergovernmental cooperation in a wartime emergency in the United States has already been accomplished, we feel that the complexity of the administrative problem, as illustrated by the British experience, is such that further study and planning are necessary.

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